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THE FAUNA AND THE CORRELATION OF THE
BAILEY LIMESTONE IN THE LITTLE SALINE
CREEK AREA OF STE. GENEVIEVE COUNTY,
MISSOURI

A DISSERTATION

SUBMITTED TO THE FACULTY
OF THE OGDEN GRADUATE SCHOOL OF SCIENCE
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOLOGY AND PALEONTOLOGY

BY

VIVIAN OURAY TANSEY

Private Edition, Distributed By
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CHAPTER III

THE FAUNA AND THE CORRELATION OF THE BAILEY
LIMESTONE IN THE LITTLE SALINE CREEK AREA
OF STE. GENEVIEVE COUNTY, MISSOURI, BY
V. O. TANSEY

The Bailey limestone was named by Ulrich from its exposure at the former Bailey's Landing on the Mississippi River, Perry County, Missouri. Fossils obtained from it at Bailey's Landing have been described by Meek and Worthen;¹ and its occurrence together with fossils collected from it along the Mississippi River in Jackson and Union Counties, Illinois, and at a point across the river in Perry County, Missouri, have been noted by Savage.² Its occurrence in Ste. Genevieve County, southeastern Missouri is described in a forthcoming report on that county by Stuart Weller.

Of the 64 or 65 species of fossils from the Bailey limestone in the Little Saline Creek area of Ste. Genevieve County, Missouri, 42 of the 49 accurately determined have been described from Lower Devonian strata of other localities.

That the Bailey limestone of this region is essentially of New Scotland age—based on the New York Helderberg; and that it is related essentially to the New Scotland of Maryland, and to the Coeymans-New Scotland of the Helderberg of New Jersey is evident from the following tables 1 and 2. Table 1 gives the fauna of the Bailey limestone in the Little Saline Creek area, and the occurrence of contained species in New York, New Jersey, Maryland, Tennessee, Oklahoma, Gaspe, Quebec, and Dalhousie, New Brunswick. Table 2 is a numerical summary, based on Table 1, of the species of the Bailey limestone as they occur in New York, New Jersey, and Maryland that brings out the relation of the Bailey limestone to the Helderberg of those states.

The description of the Bailey limestone in the Little Saline Creek region and of related strata outside of the New York-New Jersey-Maryland area are given in the following table 3 while the substantiating faunal data for such relationship is included in tables 1, 2, 4, and 5. Table 4 gives the occurrence in

¹Ill. Geol. Surv., vol. III, 1868.

²Ill. Geol. Surv., Bull. 8, pp. 112-113, 1907.

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III. Geol. Surv., vol. III, 1868.

III. Geol. Surv., Bull. 8, pp. 112-113, 1907.

the New York-New Jersey-Maryland area of those species of the strata—related to the Bailey limestone—of Tennessee, Oklahoma, Gaspe, Quebec, and Dalhousie, New Brunswick, that are not present in the fauna of the Bailey limestone in the Little Saline Creek area but are in the New York-New Jersey-Maryland region. Table 5 is a numerical summary of species, based on tables 1 and 4, that indicates the extent of equivalence between the Bailey limestone and the related strata of Tennessee, Oklahoma, Quebec, and New Brunswick through the species held in common and through the age indications as judged from the New York section of those species of the beds of Tennessee, Oklahoma, Quebec, and New Brunswick that do not occur in the Bailey limestone but are present in New York.

The Bailey limestone in the Little Saline Creek area of southeastern Missouri is practically equivalent to the Olive Hill formation plus the Birdsong shale plus the Decaturville chert of western Tennessee; it is partially equivalent to the Haragan shale plus the Bois D'Arc limestone of the Arbuckle mountain region of Oklahoma, to the St. Alban beds of Gaspe, Quebec, and to the Dalhousie formation of Dalhousie, New Brunswick.

TABLE NO. 2.

Area.	Number of species that occur in:				Number of species that are confined to:			Number of species that occur in and are confined to:		
	Coeymans, New Scotland, and Becraft.	Coeymans, New Scotland.	Becraft.	Coeymans.	New Scotland.	Becraft.	Coeymans, New Scotland, and Becraft.	Coeymans, New Scotland, and Becraft.	Coeymans, New Scotland, and Becraft.	Coeymans, New Scotland, and Becraft.
New York.....	36	13	11	2	18	0	5	5	1	1
New Jersey.....	22	13	10	6	3	0	1	4	3	3
Maryland.....	23	12	6	0	7	0	6	1	2	2

TABLE NO. 3.

Little Saline Creek Area, Ste. Genevieve Co., Missouri.¹

Bailey limestone—about 200 feet thick.

Upper member—about 100 feet thick.

Interbedded chert and limestone; lower portion highly fossiliferous.

Crystalline, highly fossiliferous, gray limestone about 5 feet thick.

Lower member—about 100 feet thick.

Shaly zone with some chert; fossiliferous.

Thin-bedded dolomite with nodules of chert a few inches in diameter.

Western Tennessee.²Decaturville chert—6 $\pm$ feet thick.

"Porous gray chert."

Break.

Birdsong shale—35-65 feet thick.

"Bluish shaly limestone and shale."

Break.

Olive Hill formation.

Flat Gap member—0-53 feet thick.

"Massive pure limestone."

Bear Branch—Pyburn member—0-45 feet thick.

"Massive limestone and oolitic hematite in north—impure cherty limestone in south."

Ross member—0-60 $\pm$ feet thick.

"Impure thin-bedded cherty limestone."

Arbuckle Mountains, Oklahoma.³

Bois d'Arc limestone—0-90 feet thick, average 60 feet.

"Thin-bedded crystalline and non-crystalline limestone with occasional chert lentils and thin beds of intercalated yellowish shale."

Hargan shale—0-166 feet thick, average 100 feet.

"Alternating blue to white shales and thin-bedded earthy limestones which weather into yellowish shales on long exposure."

Gaspé, Quebec.⁴

St. Alban beds—160 feet thick.

"Greenish calcareo-argillaceous shales, which are interstratified with less calcareous layers, of various shades of red."—90 feet.

"Gray limestones in layers of from six to eight inches thick, which are separated by bands of greenish calcareo-argillaceous shale, gradually increasing in amount towards the upper part."—70 feet.

Dalhousie, New Brunswick.⁵

Dalhousie formation.	Feet.
"From this point * * the section is concealed * * for a distance of 400 feet * * The total thickness of the sedimentary series * * is * * approximately 430 feet * *	
16. Coral reef limestone * * shaly in lower part.....	35
15. Thin white limestone.....	1.5
14. Barren shales.....	15
13. Ash bed with <i>Rensselaeria stewarti</i>	1
12. Blocky calcareous shale with gastropods (<i>Coelidium</i>).....	2
11. Ash beds alternating with thin limestones and shales all highly fossiliferous * *	30
10. Soft shales with lamellibranchs.....	10

¹Data from forthcoming report on Ste. Genevieve Co., Missouri, by Stuart Weller.²Dunbar, C. O., Tenn. Geol. Surv., Bull. 21, p. 27, 1919.³Reeds, C. A., Am. Jour. Sci., vol. 32, 4th ser., pp. 264, 265, 1911.⁴Logan quoted by Clarke, J. M., N. Y. State Mus., Mem. 9, pt. 1, p. 26, 1908.⁵Clarke, J. M., N. Y. State Mus., Mem. 9, pt. 2, pp. 11-12, 1909.

	Feet.
9. Limestones and calcareo-argillaceous shales with profusion of corals and brachiopods.	75
8. Soft calcareous shales * * very rich in <i>Leptaena rhomboidalis</i>	20
7. Compact limestone beds overlying the eruptive; contains corals and other fossils.	7
<i>Volcanic boss</i> * * near the middle of which lies a	
6. detached mass of hardened and glazed calcareous shale * * 30 feet in transverse thickness, 15 feet in height * * This mass contains corals and brachiopods.	30
5. Compacted gray blocky limestone.	10
4. Coarse conglomeratic ash bed.	12
3. Hard blocky yellowish gray argillaceous limestone.	40
2 Gray to yellowish hard calcareous shales with thin beds of limestone.	125
1. Calcareous shale with <i>Sieberella pseudogaleata</i> , <i>Leptaena rhomboidalis</i> and in the lowest stratum corals * * No contact metamorphism.	30
<i>Volcanic boss</i> * * overlain by"	

TABLE NO. 4.

[illegible]

[illegible]

TABLE NO. 4.—Continued.

Species not represented in the observed fauna of the Bailey limestone in the little Saline Creek area, Mo., but that occur in the N. Y.-N. J.-Md. region.	N. Y.-N. J.-Md. area.					Tennessee	Oklahoma.		Gaspe, Quebec.	Dalhousie, N. B.
	Below	Coeymans	New Scotland	Becraft	Above		Haragan shale	Bois d'Arc limestone		
<i>Kloedenia sussexensis</i> (Weller).....	Md.					Olive Hill formation			St. Alban beds	Dalhousie formation
<i>Kloedenella halli</i> (Jones).....	Md.	Md.				Birdsong shale				*
<i>Kloedenella pennsylvanica</i> (Jones).....	Md.					Decaturville chert				*
Totals.....						18	23	14	17	19

N. Y.-N. J.-Md. area = New York, New Jersey, Maryland, West Virginia and Pennsylvania.

x = Occurs in New York (occurrence given for New York only unless not present, in which case it is stated for Maryland; if not present in Maryland, it is given for New Jersey, Pennsylvania or West Virginia).

Md., N. J., P., W. V. = Occurs in Maryland, New Jersey, Pennsylvania, West Virginia.

OR. = Occurs in the Oriskany of New York.

SG. = Occurs in the Schoharie grit of New York.

On. = Occurs in the Onondaga of New York.

OR., Md., OR. N. J. = Occurs in the Oriskany of Maryland, of New Jersey.

* = Present in the fauna.

TABLE NO. 5.

	Tennessee.			Oklahoma.		Gaspé, Quebec.	Dalhousie, N. B.
	Olive Hill formation	Birdsong shale	Decatur- ville chert	Haragan shale	Bois d'Arc limestone		
Number of determined species.							
That are not restricted to the state or region.							
That occur in the N. Y.-N. J.-Md. area.	43	69	17	49	32	27	31
That occur in New York.	39	65	17	45	30	27	27
That occur in the Bailey limestone in the Little Saline Creek area, Mo.	38	61	17	42	26	27	23
Not in the Bailey limestone in the Little Saline Creek region, Mo., but that occur in the N. Y.-N. J.-Md. area.	25	28	10	24	17	10	8
Total.	18	41	7	23	14	17	19
Below the Coeymans.	17	37	7	20	10	17	15
In the Coeymans.	1	2	0	4	0	0	2
In the New Scotland.	3	3	0	3	1	2	3
In the Becraft.	16	35	6	15	6	12	7
Above the Becraft.	2	2	3	2	3	4	5
Not below the Oriskany.	1	3	4	3	5	4	3
Confined to the Coeymans.	0	0	0	1	4	4	3
Confined to the New Scotland.	0	0	0	0	0	1	1
Confined to the Becraft.	12	28	1	10	1	7	3
Confined to the Coeymans and New Scot- land.	0	0	0	0	0	0	2
Confined to the New Scotland and Becraft.	2	2	0	2	1	1	1
	2	2	2	1	3	4	3

DESCRIPTION OF SPECIES.

Porifera

Class SPONGIAE

Order Lithistida, Suborder Eutaxioclalina

Genus *Hindia* Duncan*Hindia fibrosa* (Roemer)¹

Plate 40, figures 1-4

Clamopora fibrosa F. Roemer (not Goldfuss), 1860, Sil. Fauna des Westl. Tenn., p. 20, pl. II, fig. 2.

Astylospongia inornata Hall, 1863, 16th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 70.

Hindia sphaeroidalis Duncan, 1879, Ann. & Mag. Nat. Hist., ser. V, vol. IV, p. 84, pl. IX.

Hindia fibrosa Hinde, 1883, Cat. Foss. Sponges Brit. Mus., p. 57, pl. XIII, fig. 1.

Hindia sphaeroidalis Rauff, 1894, Palaeospongiologie, pt. 1, p. 335, pls. 15-17, figs. 1-4.²

Hindia sphaeroidalis Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 552.

Hindia fibrosa Weller, 1903, Pal. N. J., vol. III, p. 297, pl. XXXII, figs. 1, 2.

Hindia fibrosa Clarke, 1908, N. Y. State Mus., mem. 9, pt. 1, p. 116.

Hindia fibrosa Clarke, 1909, N. Y. State Mus., mem. 9, pt. 2, p. 50.

Hindia sphaeroidalis Swartz, 1913, Md. Geol. Surv., L. Dev., p. 195, pl. XVII, figs. 1-4.

Description—"Spherical, consisting of minute spicules uniting to form a series of delicate, straight canals which radiate from the center of the sponge and increase by bifurcation. The canals open upon the surface by polygonal orifices. The minute structure of this species was worked out by Rauff, and subsequently discussed critically by Hinde, Ulrich and Girty.

"Rauff showed that it consists of spicules, each of which bears 4 rays which diverge from a common center. Three of the rays are stout, slightly curved, concave on the inner side denticulate on the outer side and have expanded denticulate extremities. The fourth ray is small and directed towards the exterior. It is often abortive. The whole structure consists of superimposed series of these spicules. The manner in which they unite to form the canals is illustrated diagrammatically in fig. 3 [p. 196]. Three spicules, whose centers form the angles of the cell, lie on one level while three alternating spicules, whose centers are dotted in the diagram, lie at a slightly higher level in the structure, their rays descending obliquely upon the rays of the first set, the third layer repeating the first, etc. In this manner walls are built up around the canals which are perforated by openings, placing the interior of the adjacent canals in communication. The form of an individual spicule and the manner in which it articulates with its neighbors is shown in fig. 4 [p. 196] while the manner in which they unite to form the walls of the canal is shown in fig. 5 [p. 197]. Excellently preserved specimens showing the inner structure are found at Keyser, West Virginia.

"Position of the genus has been much discussed. Steinmann regarded it as a form of Favosites. Rauff determined its true character, showing that it is a sponge and regarded it as one of the siliceous sponges.

"Diameter of spheres, 25 mm. or at times a little greater. They are frequently somewhat distorted by compression."—Swartz, 1913.

Dimensions—Mean diameter of sponges 7.8 to about 48 mm.

¹See Clarke, J. M., N. Y. State Mus., Mem. 9, pt. 2, pp 50-51, 1909.

²For additional references through 1895, see Md. Geol. Surv., L. Dev., p. 195.

COELENTERATA

Class ANTHOZOA

Subclass Tetracoralla

Family Zaphrentidae

Genus *Streptelasma* Hall*Streptelasma strictum* Hall

Plate 40, figures 5-11

Streptelasma (*Petraia*) *stricta* Hall, 1874, 26th Ann. Rept. N. Y. State Mus. Nat. Hist., p. 114.

Streptelasma stricta Hall, 1879, 32nd Ann. Rept. N. Y. State Mus. Nat. Hist., p. 142.

Streptelasma strictum Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. I, figs. 1-10.

Streptelasma strictum Hall, 1887, Pal. N. Y., vol. VI, p. 1, pl. I, figs. 1-10.

Streptelasma strictum Girty, 1895, 48th Ann. Rept. N. Y. State Mus. Nat. Hist., vol. II p. 300.

Enterolasma strictum Simpson, 1900, N. Y. State Mus., Bull. 39, p. 203, figs. 11, 12 (p. 204).

Streptelasma strictum Weller, 1903, Pal. N. J., vol. III, p. 298, pl. XXXIII, figs. 3, 4.

Enterolasma (*Streptelasma*) *strictum* Shimer, 1905, N. Y. State Mus., Bull. 80, p. 235.

Streptelasma strictum Swartz, 1913, Md. Geol. Surv., L. Dev., p. 198, pl. XVII, figs. 5-9.

Description—"Corallum simple, conical, very gradually and regularly enlarging; straight or very slightly curved, except at the apex, which is sometimes more abruptly bent. Exterior marked with strong undulations of growth and numerous fine concentric striae; external rays very prominent, from forty-five to fifty at a point where the diameter of the corallum is 15 mm.; the increase in number taking place usually at three distinct points, but sometimes at only two

"Calix deep, sides thin and nearly erect; a flat space at the bottom. In one calix, having a diameter of 20 mm., there are fifty-four lamellae; alternate lamellae extending only a short distance from the walls at the base of the calix and frequently coalescing with the primary lamellae. For some distance below the calix-margin the lamellae are of the same size, their edges smooth and rounded, becoming sharp below, and their sides often distinctly granulose or spinulose. The primary lamellae unite and coalesce at the center of the calix, forming an indistinct plate or vesiculose core from 3 to 5 mm. in diameter. Fossette obscure or obsolete."—Hall, 1887.

Dimensions—Figured specimens indicate range in size of coralla.

Subclass Tabulata

Family Favositidae

Genus *Favosites* Lamarck*Favosites helderbergiae* Hall

Plate 40, figures 12-17; plate 41, figure 1

Favosites helderbergiae Hall, 1874, 26th Ann. Rept. N. Y. State Mus. Nat. Hist., p. 111.

Favosites helderbergiae Hall, 1879, 32nd Ann. Rept. N. Y. State Mus. Nat. Hist., p. 145.

Favosites helderbergiae Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. IV, figs. 1, 2; pl. V, figs. 1-3; pl. VI, figs. 1-8.

Favosites helderbergiae Hall, 1887, Pal. N. Y., vol. VI, p. 8, pl. IV, figs. 1, 2; pl. V, figs. 1-3; pl. VI, figs. 1-8.

Favosites helderbergiae Girty, 1895, 48th Ann. Rept. N. Y. State Mus. Nat. Hist., vol. II, pl. 302.

Favosites helderbergiae Weller, 1903, Pal. N. J., vol. III, p. 270.

Favosites helderbergiae Shimer, 1905, N. Y. State Mus., Bull. 80, p. 235.

Favosites helderbergiae Clarke, 1908, N. Y. State Mus., mem. 9, pt. 1, pp. 113, 218.

Favosites helderbergiae Clarke, 1909, N. Y. State Mus., mem. 9, pt. 2, p. 49.

Favosites helderbergiae Grabau and Shimer, 1909, N. Am. Index Foss., vol. I, p. 85, fig. 138.

Favosites helderbergiae Swartz, 1913, Md. Geol. Surv., L. Dev., p. 208, pl. XXII, fig. 1.

Description—"Corallum consisting of large, lenticular, depressed convex or hemispherical masses; base covered by a strongly wrinkled epitheca. Cell tubes polygonal; their inner surface showing evidence of a few strong longitudinal striae. Septa frequent, from ten to fifteen in the space of 10 mm.; thickness equal to that of the cell walls. Mural pores in one or two ranges, comparatively large, circular, with margins distinctly elevated. Cell walls thin, but frequently much thickened near the surface by silicification, and sometimes granulose or spinulose on the inner face. On some specimens the cells, at the surface, are nearly equal, having a diameter of about 1.5 mm.; on other specimens the diameter varies from .66 mm. to 1.5 mm.

"On many specimens some of the cell tubes are larger and less angular than those surrounding them, being a little more than 2 mm. in diameter. A single specimen from Coeymans Landing has slightly larger tubes on one portion, while on all the other parts the cells have the ordinary characters."—Hall, 1887.

Dimensions—Figured specimens indicate variation in size of coralla. Range in greatest internal diameter of corallites of the various specimens about 0.25 to 2.25 mm.; maximum range for any one specimen 0.7 to 2.25 mm.

Remarks—The specimens represent coralla of various shapes.

Hall figures a specimen of *F. helderbergiae* from New York "which differs from the prevailing specimens in having numerous and somewhat regularly distributed larger cells which are subcircular at their apertures."¹ This character prevails among the Missouri specimens.

The arrangement of the tabulae is accurately determinable only on portions of two of the specimens. The disposition of the mural pores is accurately determinable, and the septal spines are observable (to the unaided eye) on portions of all of the specimens. Two of the specimens show epitheca.

Favosites conicus Hall

Plate 41, figures 2-7

Favosites conica Hall, 1874, 26th Ann. Rept. N. Y. State Mus. Nat. Hist., p. 112.

Favosites conica Hall 1879, 32nd Ann. Rept. N. Y. State Mus. Nat. Hist., p. 146.

Favosites conicus Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. III, figs. 4, 6-13.

Favosites conicus Hall, 1887, Pal. N. Y., vol. VI, p. 9, pl. III, figs. 4, 6-13.

Favosites conicus Girty, 1895, 48th Ann. Rept. N. Y. State Mus. Nat. Hist., vol. II, p. 302.

Favosites conicus Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 560.

Favosites conicus Swartz, 1913, Md. Geol. Surv., L. Dev., p. 212, pl. XXIII, figs. 5-7.

Description—"Corallum forming conical masses; flattened at the base, which is covered by a strong epitheca, marked with concentric wrinkles and undulations and radiating undulations formed by the cell tubes. Cells arising from the center of the base and from an undefined central axis and quite abruptly curving to the surface, increasing by interstitial additions; polygonal, from four to eight-sided; diameter at the surface varying from 1.5 to 3.5 mm.; walls comparatively strong; interior with evidences of numerous spinules or small nodes. Tabulae of about the same strength as the walls,

¹Pal. N. Y., vol. VI, pl. VI, fig. 1, 1887.

irregularly arranged, varying from eight to fifteen in the space of 10 mm. Mural pores comparatively large, circular, with distinctly elevated margins, disposed in one, two and sometimes three ranges. Where one or two ranges occur the pores are regularly arranged one above the other; where three ranges occur the disposition is more irregular."—Hall, 1887.

Dimensions—Variation in size of coralla indicated by specimens figured. Range in greatest internal diameter of corallites of the various specimens and maximum range for any one specimen 0.8 to 3.5 mm.

Remarks—The arrangement of the tabulae is accurately determinable on portions of part of the specimens. The disposition of the mural pores is accurately determinable, and the septal spines are observable (to the unaided eye) on portions of all of the specimens. Epitheca is shown on all of the specimens.

Genus *Striatopora* Hall

Striatopora missouriensis Meek and Worthen?

Plate 42, figures 1-4

Striatopora missouriensis Meek and Worthen, 1868, Ill. Geol. Surv., vol. III, pl. 369, pl. 7, fig. 4.

Striatopora missouriensis Keyes, 1894, Mo. Geol. Surv., vol. IV, pt. I, p. 121.

Description—"Corallum slender, ramose; branches cylindrical; cells obliquely ascending from an imaginary axis, rather distantly separated, slender and rounded within, but enlarging and curving outwards to the surface, where they terminate in comparatively large, transversely oval, or subrhombic mouths, alternately arranged, and directed more or less obliquely upwards, with a sharp, rather prominent lip below; striae distinct, ascending from each cell, and continued up the upper side of the enlarged opening, to the lower margins of the succeeding openings above.

"Length unknown; diameter of an imperfect branch, about 0.20 inch."—Meek and Worthen, 1868.

Remarks—Meek and Worthen's figure of *S. missouriensis* is too poor to permit more than doubtful reference of the material at hand to this species from the *Helderbergian* of Missouri. The specimens might be assigned to *S. issa* Hall¹.

A description of the material at hand follows: Corallum ramose, composed of closely united corallites (whose orifices are polygonal and unequal in diameter) which ascend obliquely from axis, rapidly increase in size, and end obliquely upon surface. Calyces funnel-shaped, sides marked by prominent longitudinal ridges that produce crenulation of thin calyx-edges, walls pierced by comparatively large mural pores.

Mean diameter of branches 6.5 to 15.0 mm. Range in greatest diameter of corallites of the various specimens, and maximum range for any one specimen 1.0 to 4.0 mm.

The specimens differ from *S. bella* Swartz in that the calyces narrow more rapidly downward and the calyx-ridges are more prominent.

Striatopora bella Swartz

Plate 42, figures 5-8

Striatopora bella Swartz, 1913, Md. Geol. Surv., L. Dev., p. 215, pl. XXV, figs. 1, 2.

Description—"Corallum branching, dendroid, consisting of closely united prismatic corallites which ascend along axis and then bend abruptly, terminating obliquely upon surface; corallites quite unequal in diameter, more or less irregular in cross-section. Calyx funnel-shaped, its base formed by a broad, flat tabula, its sides striated by twelve low ridges, its edges thin and slightly crenulated by the termination of the ridges. Walls of calyx perforated by large scattered pores. An occasional pore is seen to pierce the tabulae in the single specimen observed.

¹26th Ann. Rept. N. Y. State Mus. Nat. Hist., p. 114, 1874.

"Diameter of corallum 5 to 10 mm. Diameter of orifices varying with maturity of corallite from 1 to 2.5 mm.

"This species differs from *S. issa* Hall in its less conical calyx with less prominent furrows. It differs from *S. cavernosa* Rom. which has more funnel-like calyces with obtuse edges."—Swartz, 1913.

Dimensions—Mean diameter of branches 6.5 to about 13.5 mm. Range in greatest diameter of corallites of the various specimens, and maximum range for any one specimen 0.8 to 3.5 mm.

Genus *Pleurodictyum* Goldfuss

Pleurodictyum lenticulare (Hall) ?

Plate 42, figure 9

Michelinia lenticularis Hall, 1874, 26th Ann. Rept. N. Y. State Mus. Nat. Hist. p. 113.

Michelinia lenticularis Hall, 1879, 32nd Ann. Rept. N. Y. State Mus. Nat. Hist. p. 145.

Michelinia lenticularis Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. III, figs. 1-3, 5.

Michelinia lenticularis Hall, 1887, Pal. N. Y., vol. VI, p. 7, pl. III, figs. 1-3, 5.

Pleurodictyum lenticulare Beecher, 1891, Trans. Conn., Acad. vol. VIII, p. 207.

Pleurodictyum lenticulare Girty, 1895, 48th Ann. Rept. N. Y. State Mus. Nat. Hist., vol. II, p. 305.

Pleurodictyum lenticulare Swartz, 1913, Md. Geol. Surv., L. Dev., p. 218, pl. XXVI, fig. 1.

Description—"Corallum forming small lenticular bodies, the lower surface usually the less convex and covered with a strongly wrinkled epitheca. Cells large and few, usually from seven to twelve; broadly campanulate. Partition walls about 1 mm. thick; strongly marked longitudinally by nodose striations; denticulate on the margins. The number of striations and denticulations varies with the size of the cell.

"In a characteristic specimen 20 mm. in diameter, there are eight cells, the central one having a diameter of 11 mm., and the peripheral cells measuring from 6 to 8 mm. across. The entire height of this specimen is 9 mm.

"[*Remarks*]"—This is a very small species, seldom attaining a diameter, of more than 25 mm., and is distinguished by its large cells and their strongly granulose-striate character. A small individual 10 mm. in diameter shows one large central cell and six smaller ones around the margin, also an incipient seventh cell. Occasionally there are two central cells in large individuals, and the number of peripheral cells in such specimens is from ten to twelve."—Hall, 1887.

Dimensions—Diameter of corallum undeterminable.

Remarks—On a fragment of rock are two detached groups of corallites which probably are parts of one corallum; one group shows portions of nine corallites, the other of four corallites. The nature of the base of the corallum represented is undeterminable.

ECHINODERMATA

Class CRINOIDEA

Order Camerata

Family Melocrinidae

Genus *Scyphocrinus* Zenker

Scyphocrinus sp.

Plate 42, figure 10; plate 43, figures 1-6

Description—This genus is represented by several parts of calyces and root-bulbs that are provisionally regarded as of a single species.¹

¹The "inflated or bulbous root" of *Scyphocrinus* was described as *Camarocrinus* by Hall and as *Lobolithus* by Barrande. See von Zittel's Text-book of Pal., vol. I, pp. 160 and 190, 1913.

Dimensions—Specimens figured indicate range in size of calyces. Greatest transverse diameter of root-bulbs about 35 to about 130 mm.

Order Inadunata

Suborder Fistulata

Family Poteriocrinidae

Genus *Alsopocrinus* n. g.

Description—Dorsal cup obconic. Infrabasals three, affected by disk-like depression for reception of column. Radials with straight facet and transverse ridge. Radial rests upon one face of posterior basal and one face of right posterior basal. Anal unknown, in line with radials. Tegmen, arms and column unknown.

Remarks—This genus and the following species are founded upon a single, incomplete dorsal cup.

The character of the facet, and the transverse ridge is determinable only on the anterior, right anterior, and left posterior radials.

Alsopocrinus anna n. sp.

Plate 44, figures 4-6

Description—Dorsal cup obconic. Infrabasals three, affected by disk-like depression for reception of column, extend beyond periphery of column; two pentagonal, with truncate distal margins; one that lies in part below posterior basal and in part below right posterior basal smaller, quadrangular, with angular distal margin. Basals, posterior and right posterior ones hexagonal, others pentagonal. Radials with straight facet and transverse ridge,¹ four pentagonal, shape of right posterior one unknown. Radial rests upon one face of posterior basal and one face of right posterior basal. Anal unknown, in line with radials. Tegmen, arms and column unknown.

Dimensions—Dorsal cup: Height 6.0 mm., proximal diameter 3.25 mm., distal diameter about 8.0 mm.

Remarks—The shape of the anal, radial, and right posterior radial are undeterminable because the anal is missing, and the radial and right posterior radial are incomplete.

Genus *Edriocrinus* Hall

Edriocrinus ? sp.

Plate 44, figures 1-3

Description—A portion of a calyx is doubtfully referred to this genus.

MOLLUSCOIDEA

Class BRYOZOA

Order Cyclostomata

Suborder Ceramoporoidea

Family Fistuliporidae

Genus *Fistulipora* M'Coy

Fistulipora ? sp.

Plate 44, figure 7

Description—A silicified portion of a zoarium is doubtfully referred to this genus.

¹See remarks under *Alsopocrinus* n. g.

Order Cryptostomata

Family Fenestellidae

Genus *Fenestella* Lonsdale*Fenestella* ? sp.

Plate 44, figure 8

Description—The specimen is a silicified fragment of a zoarium which shows only the non-celluliferous surface.

CLASS BRACHIOPODA¹

Order Neotremata

Superfamily Craniacea

Family Craniidae

Genus *Crania* Betzius*Crania alsopi* n. sp.

Plate 44, figures 9-11

Description—Dorsal valve prominently elevated; surface ornamented with radiating costae, that increase toward margin, crossed by concentric growth lines. One specimen with diameter of about 7 mm. has about 112 radiating costae at margin.

Remarks—The relation between the diameter of the dorsal valve and the number of radiating costae is determinable on but one of the two specimens (attached to a specimen of *Meristella atoka*) observed.

Order Protremata

Sub Orthacea

Family Orthidae

Genus *Dalmanella* Hall and Clarke*Dalmanella planoconvexa* (Hall)

Plate 44, figures 12-17

Orthis planoconvexa Hall, 1859, Pal. N. Y., vol. III, p. 168, pl. XII, figs. 1-6, 1861.

Dalmanella planoconvexa Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, pp. 207, 224.

Dalmanella planoconvexa Clarke, 1909, N. Y. State Mus., mem. 9, pt. 2, p. 145.

Dalmanella planoconvexa Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 298, pl. LIV, figs. 1-6.

Description—"Shell plano-convex; outline somewhat circular or transversely oval; length and breadth about as ten to twelve. Dorsal valve nearly flat, slightly prominent near the beak on either side of the faint central depression, and quite flat towards the margins. Ventral valve convex, sometimes scarcely subangular towards the beak; greatest convexity a little above the middle of the shell, and thence sloping uniformly to the lateral and basal margins; beak small, acute, incurved. Area linear, its length

¹For each species, the range in size of the shells is indicated by the figured specimens.

greater than half the width of the shell. Striae fasciculate, much curved upwards towards the cardinal and lateral margins.

["Remarks] * * * * *

" * In the dorsal valve the lamellae bordering the muscular areas which diverge abruptly, and then becoming almost obsolete, curve so as to enclose a broad oval space with a depressed line through the center * * In the ventral valve the lamellae are broadly divergent and, becoming gradually obsolete, are nearly lost and leave scarcely an impression in the cast. The imprint of the adductor muscles forms a small scar towards the upper part of the vascular area

* * * * * Hall, 1859.

Dalmanella perelegans (Hall)

Plate 44, figures 18-26

Orthis perelegans Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist. p. 44, fig. 1.

Orthis perelegans Hall, 1859, Pal. N. Y., vol. III, p. 171, pl. XIII, figs. 4-12, 1861.

Orthis perelegans Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. XXXV, figs. 32, 33.

Dalmanella perelegans Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, pp. 207, 224, pl. VC, figs. 34, 35.

Dalmanella perelegans Clarke, 1900, N. Y. State Mus., mem. 3, p. 57.

Dalmanella perelegans Weller, 1903, Pal. N. J., vol. III, pp. 305, 327, pl. XXXV, figs. 5-8.

Dalmanella perelegans Shimer, 1905, N. Y. State Mus., Bull. 80, p. 243.

Dalmanella perelegans Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 299, pl. LIV, figs. 14-23.

Dalmanella perelegans Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 9.

Description—"Shell transversely oval; valves nearly equally convex. Dorsal valve subventricose, more or less depressed along the middle from near the beak to the front; beak small little elevated above the hinge line. Ventral valve elevated along the middle from the beak towards the front and sloping laterally; beak small, pointed, incurved, extending beyond that of the opposite valve. Cardinal margin generally sloping a little from the beaks, and rounding imperceptibly into the lateral margins. Area narrow, nearly half as long as the width of the shell. Foramen broad triangular, extending nearly to the apex of the beak. Surface marked by fine irregular bifurcating longitudinal striae, crossed by concentric lines of growth.

["Remarks] * * The ventral valve, although strongly elevated in the centre towards the beak, is not subcarinate * * and this gibbosity is lost before reaching the base. Along the middle of the dorsal valve there is a broad undefined depression, which is more conspicuous in the upper part, from the beak half way to the base; below which point, it becomes scarcely marked as a distinguishing character of the shell * * , The striae of this species are often fasciculate; the stronger ones separated by three, four, five or six smaller ones * *

* * * * * —Hall, 1859.

Dalmanella quadrans (Hall)

Plate 44, figures 27-31

Orthis quadrans Hall, 1859, Pal. N. Y., vol. III, p. 170, pl. XII, figs. 9-12, 1861.

Dalmanella quadrans Hall and Clarke, 1892, Pal. N. Y. vol. VIII, pt. I, p. 224.

Description—Shell subquadrangular, valves unequally convex, anterior border emarginate, anterior line of junction of valves sinuate. Ventral valve more convex than dorsal valve, most convex in middle, with prominent mesial elevation from beak nearly, or quite, to anterior margin; beak conspicuous, incurved. Cardinal area about $\frac{2}{3}$ width of shell, delthyrium comparatively large. Dorsal valve with pronounced mesial depression from beak to anterior margin; beak inconspicuous, incurved. Surface ornamented with radiating, bifurcating, fasciculate costae—4 to 5 in 1 mm. at anterior border—crossed by concentric growth lines.

Family Rhipidomellidae

Genus Rhipidomella Oehlert

Rhipidomella oblata (Hall)

Plate 44, figures 32, 33; plate 45, figures 1-8

Orthis oblata Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 41, figs. 1-5*Orthis oblata* Hall, 1859, Pal. N. Y., vol. III, p. 162, pl. X, figs. 1-17, 19-22, 1861.*Orthis oblata* Whitfield, 1882, Geol. Wis., vol. IV, p. 320, pl. 25, figs. 1, 2.*Rhipidomella oblata* Hall and Clarke, 1892, Pal. N. J., vol. VIII, pt. I, pp. 210, 225, pl. VIa, figs. 3, 4.*Rhipidomella oblata* Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 562, pl. LXX, fig. 3a.*Rhipidomella oblata* Clarke, 1900, N. Y. State Mus., mem. 3, p. 58, pl. 8, figs. 14, 15.*Rhipidomella oblata* Weller, 1903, Pal. N. J., vol. III, pp. 304, 350, pl. XXXV, figs. 9-13; pl. XLVI, figs. 5-7.*Rhipidomella oblata* Shimer, 1905, N. Y. State Mus., Bull. 80, p. 244.*Rhipidomella oblata* Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 303, pl. LV, figs. 9-16*Rhipidomella oblata* Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. I, fig. 1.

Description—"Shell in the young state longitudinally subovate, and varying from circular to transversely oval in its stages of growth, resupinate. Ventral valve convex at the beak, flattened in the middle, and concave towards the front. Dorsal valve very convex in the middle and towards the beak; beaks of the two valves nearly equally elevated; that of the ventral valve pointed; area very small; foramen large. Surface finely striated; striae frequently bifurcating and curving towards the lateral and cardinal margins, concentrically marked by finer striae and stronger lines of growth, which are numerous in the older shells.

"Internally the ventral valve is marked by a large foliate vascular impression; impressions of the adductor muscles rarely well preserved, except in the casts. Teeth prominent, and, when entire, rounded and thickened at their extremities. Dorsal valve with a prominent cardinal process and divergent brachial lamellae; a central ridge, more or less prominent, extends from beneath the beak to near the base.

"[Remarks] * * * The ventral valve is marked by a broad undefined depression down the centre, making the entire valve broadly concave from a little below the beak, and producing a sinuous outline in front. The dorsal valve maintains a generally uniform convexity, its greatest height being towards the beak.

"In young and half-grown shells the length and height are nearly equal, while in older specimens the proportions of length and breadth are often as three to four * * *

—Hall, 1859.

Remarks—In the case of the observed specimens, either the convexity of the dorsal valve is uninterrupted, or the valve is slightly flattened, medially, from the beak to the anterior margin.

Rhipidomella discus (Hall)

Plate 45, figures 9-16

Orthis discus Hall, 1859, Pal. N. Y., vol. III, p. 165, pl. Xa, figs. 7-12, 1861.*Rhipidomella discus* Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, pp. 210, 225.

Description—"Shell circular; valves moderately and nearly equally convex. Dorsal valve flattened or slightly depressed in the centre near the beak, the depression becoming broader and undefined below the middle of the shell. Ventral valve regularly convex, becoming flattened towards the lateral and basal margins, sometimes a little elevated in the middle. Area narrow; length equal to or greater than half the width of the shell.

Foramen large, usually filled with the trifid cardinal process. Surface finely striated; striae somewhat in fascicles, abruptly bending upwards towards the hinge line. Ventral valve with a small vascular impression."—Hall, 1859.

Rhipidomella ellsworthi n. sp.

Plate 45, figures 17-39,

Orthis hybrida? Meek and Worthen, 1868, Ill. Geol. Surv., vol. III, p. 371, pl. 7, figs. 7a-d.

Description—Shell subquadrangular to transversely suboval in outline, valves about equally convex, anterior border uninterrupted to emarginate, anterior line of junction of valves straight to sinuate. Dorsal valve marked, medially, from beak to front by a distinct, rounded depression flanked on each side by a distinct, rounded ridge; beak inconspicuous, incurved. Ventral valve most convex posterior to middle; either marked, medially, from beak toward, or to, anterior margin by an indistinct, rounded ridge bordered on each side by an indistinct, rounded depression—ridge corresponds in position with depression in dorsal valve, and depressions correspond with ridges on dorsal valve, or marked, medially, from anterior margin posteriorly by a shallow depression whose width at anterior margin approximates distance between apices of ridges of dorsal valve at anterior border; beak prominent, incurved. Length of cardinal area half to less than half width of shell, delthyrium comparatively large. Surface ornamented by radiating costae—3 to 4 in 1 mm. at anterior border—that increase by bifurcation, crossed by concentric growth lines.

Remarks—This species most closely resembles *R. discus* (Hall).

Meek and Worthen's material was obtained from the Bailey limestone at Bailey's Landing, Perry County, Missouri.

Rhipidomella melvillei n. sp.

Plate 46, figures 1-17

Description—Shell subpentagonal in outline, valves about equally convex, anterior line of junction of valves straight to sinuate. Ventral valve most convex posterior to middle; convexity of valve uninterrupted, or valve flattened, or shallowly depressed, medially, from anterior margin posteriorly; beak prominent, incurved over that of dorsal valve. Dorsal valve flattened, or shallowly depressed, medially, from beak toward, or to, anterior margin; beak inconspicuous, incurved. Cardinal area equal to or greater than half width of shell, delthyrium relatively large. Surface marked by radiating costae—4 in 1 mm. at anterior margin—that increase by bifurcation, crossed by concentric lines of growth.

Remarks—This species is quite distinct.

Genus *Bilobites* Linn

Bilobites varica (Conrad)

Plate 46, figures 18-25

Delthyris bilobata Conrad (not *Orthis bilobata* Sowerby), 1838, 2nd Ann. Rept. N. Y. Geol. Surv., pp. 112, 118.

Delthyris varica Conrad, 1842, Jour. Acad. Nat. Sci., Philadelphia, vol. VIII, p. 262, pl., 14 fig. 20.

Orthis varica, Hall 1859, Pal. N. Y., vol. III, p. 179, pl. XXIV, figs. 1a-i, k, 1861.

Orthis (Dicoelosia) varica Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. XXXV, figs. 38-40.

Bilobites varicus Beecher, 1891, Am. Jour. Sci., 3rd ser., vol. XLII, p. 52, pl. I, figs. 3-27.

Bilobites varcius Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, pp. 204, 205, 223, pl. Vb figs. 15-19.

Bilobites varica Weller 1903, Pal. N. J., vol. III, p. 306, pl. XXXV, figs. 14-18.

Bilobites varicus Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 4.

Description—"Shell subcordiform ventricose, deeply bilobed at the base, with a deep sulcus upon each valve reaching to the beaks; hinge line short. Area common to both valves; that of the ventral valve higher. Foramen high and narrow. Ventral valve acute, ventricose on each side of the sinus. Dorsal valve gibbous on each side the mesial sinus; each lobe becoming angular towards the beak, and compressed toward the cardinal extremities. Surface unequally striated; a few distant striae being visible to the naked eye, while under a lens the interspaces are seen to be distinctly striated. Fine concentric striae cross the radiating striae, and become conspicuous towards the base of the shell."—Hall, 1859.

Superfamily Strophomenacea

Family Strophomenidae

Genus *Leptaena* Dalman

Leptaena rhomboidalis (Wilckens)

Plate 46, figures 26-32

Conchila rhomboidalis Wilckens, 1769, Nachricht von selten Versteinerungen, p. 77 pl. VIII, figs. 43, 44.

Strophomena rugosa Hall, 1859, Pal. N. Y. vol. III, p. 195, pl. XIX, figs. 1a-y, 1861.

Leptaena rhomboidalis Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I p. 279, pl. VIII figs. 17-31; pl. XVa, figs. 40-42; pl. XX, figs. 21-24.

Plectambonites rhomboidalis Keyes, 1894, Mo. Geol. Surv., vol. V, p. 70, pl. XXXIX, fig. 6.¹

Leptaena rhomboidalis Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 563.

Leptaena rhomboidalis Clarke, 1900, N. Y. State Mus., mem. 3, p. 57.

Leptaena rhomboidalis Weller, 1903, Pal. N. J., vol. III, pp. 278, 302, pl. XXVII, fig. 9 pl. XXXIII, fig. 10.

Leptaena rhomboidalis Shimer, 1905, N. Y. State Mus., Bull. 80, p. 240.

Leptaena rhomboidalis Clarke, 1908, N. Y. State Mus., mem. 9, pt. 1, pp. 111, 116, 183, pl. 34, figs. 1-3.

Leptaena rhomboidalis Clarke, 1909, N. Y. State Mus., mem. 9, pt. 2, pp. 45, 122, pl. 10, figs. 1-6.

Leptaena rhomboidalis Maynard, 1913, Md. Geol. Surv., L. Dev., p. 308, pl. LVI, figs. 13-17.

Leptaena rhomboidalis Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 17.

Description—"Shell varying from semioval to semicircular. Hinge line equalling or greater than the width of the shell below; cardinal extremities often much extended. Dorsal valve flat or slightly concave in the upper part, and abruptly curving or inflated towards the front; beak prominent, perforate at its apex, and filling a deep sinus in the opposite valve. Ventral valve slightly convex or nearly flat in its upper part, and sometimes even concave; convex upon the umbo, often perforate near the beak; abruptly deflected or geniculate towards the front; cardinal area narrow, linear, partially occupying both valves. Foramen of the ventral valve a broad, shallow sinus, which is filled by the prominent cardinal process of the opposite valve, the latter being perforate or

¹For complete bibliography to 1897, see Schuchert, C., U. S. Geol. Surv., Bull. 87, p. 240, 1897.

deeply grooved for the passage of a pedicle. Surface marked by regular, rounded, radiating striae, which increase by bifurcation and interstitial addition; the upper part of the valves marked by strong concentric wrinkles which do not extend below the abrupt bending of the valves.

"The interior of the shell is striato-punctate, or sometimes simply punctate. The muscular areas of the ventral valve are strong, more or less deeply bilobed, and limited by the extension of the dental lamellae. The interior of the dorsal valve is strongly marked by the muscular impressions; the dental process perforate near its outer surface, or deeply grooved; and there is often a deep cavity below this, extending towards the beak.

"[Remarks]—This shell exhibits much variety of form, being sometimes nearly flat or but slightly curved near the margin; and the corrugations are variable in number and strength. In very old shells they are often not as prominent as in younger ones, or those of medium size. The area, as usually exposed, is subject to much variation, and not unfrequently the valves are so closed as to leave no visible area. The beak of the dorsal valve, either at or just within its extremity, shows a rounded perforation or groove; and the beak of the opposite valve is marked by a rounded, shallow groove, which, extending downwards, often ends in a perforation both in young and old shells. Sometimes the groove only is visible, the perforation having doubtless once existed, but subsequently closed. In some specimens there is a simple indentation on the beak"—Hall 1859.

Genus *Stropheodonta* Hall

Stropheodonta arata (Hall)

Plate 46, figures 33-35

Strophodonta varistriata var. *arata* Hall, 1859, Pal. N. Y., vol. III, p. 183, pl. XVIII figs. 1a-i, 1861.

Strophodonta varistriata var. *arata* Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. XLIV, figs. 17, 18.

Stropheodonta varistriata var. *arata* Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, pl. XIII, figs. 17, 18.

Stropheodonta varistriata var. *arata* Weller, 1903, Pal. N. J., vol. III, p. 275, pl. XXVII, fig. 3.

Stropheodonta varistriata var. *arata* Shimer, 1905, N. Y. State Mus., Bull. 80, p. 241.

Stropheodonta arata Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 311, pl. LVII, figs. 7-10.

Description—"Shell semi-elliptical, with the cardinal extremities more or less salient; hinge crenulate. Dorsal valve more or less concave. Ventral valve varying from moderately convex to very gibbous, and sometimes geniculate towards the front. Area narrow. Foramen none, or a narrow elevation or callosity in place of it. Surface marked by very prominent sharp angular ridges and intermediate fine undulating striae, which cover also the slopes of the ridges. Sometimes a few short wrinkles mark the spaces between the ridges, along the cardinal margin towards the hinge extremities."—Hall, 1859.

Stropheodonta (Leptostrophia) planulata (Hall)

Plate 46, figures 36-38; plate 47, figures 1, 2

Strophodonta planulata Hall, 1859, Pal. N. Y., vol. III, p. 184, pl. XVI, figs. 9-12, 1861.

Stropheodonta planulata Schuchert, 1897, U. S. Geol. Surv., Bull. 87, p. 426.

Stropheodonta planulata Weller, 1903, Pal. N. J., vol. III, p. 276, pl. XXVII, figs. 1, 2.

Stropheodonta (Leptostrophia) planulata Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 315, pl. LVII, figs. 14-16.

Description—"Shell semi-elliptical, width nearly one-half the length, plano-convex; hinge line greater than the width of the shell below; the cardinal extremities often salient. Dorsal valve flat. Ventral valve uniformly and very slightly convex, sometimes flattened towards the margins; beak scarcely elevated above the hinge line. Area linear. Foramen unknown. Surface finely and evenly striated; striae of the dorsal valve often flattened. Radiating striae crossed by fine closely arranged concentric striae, and sometimes with a few inconspicuous laminae of growth, and towards the cardinal extremities by a few wrinkles or undulations.

"[Remarks] * * * The striae are fine, equal or subequal, gently undulating, and increasing both by bifurcation and interstitial addition. A very slight exfoliation obliterates the concentric striae. The surface, when very slightly weathered, presents numerous punctures arranged in lines parallel with the striae; and these punctures are often visible upon the fresh unworn surface * * *

—Hall, 1859.

Genus *Strophonella* Hall

Strophonella punctulifera (Conrad)

Plate 47, figures 3-6

- Leptaena punctulifera* Conrad, 1838, 2nd Rept. N. Y. Geol. Surv., pp. 112, 117.
Strophomena punctulifera Vanuxem, 1842, Geol. N. Y., Rept. 3rd Dist., p. 122, fig. 5.
Strophomena (Strophodonta) punctulifera Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 50, fig. 1.
Strophodonta cavumbona Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 51.
Strophomena punctulifera Rogers, 1858, Geol. Penn., vol. II, pt. II, p. 825, fig. 648.
Strophodonta punctulifera Hall, 1859, Pal. N. Y., vol. III, p. 188, pl. XXI, figs. 4a, b; pl. XXIII, figs. 4 a-c, 5c, 7e, 1861.
Strophodonta cavumbona Hall, 1859, Pal. N. Y., vol. III, pl. 187, pl. XXI, figs. 1-3, 1861.
Strophomena punctulifera Billings, 1863, Proc. Portland Soc. Nat. Hist., p. 108, pl. 3, fig. 2.
Strophomena punctulifera Billings, 1863, Geol. Canada, p. 957, fig. 448.
Strophomena punctulifera Billings, 1874, Pal. Fossils, vol. II, p. 31, pl. 3, fig. 2.
Strophonella punctulifera Hall, 1879, 28th Ann. Rept. N. Y. State Mus. Nat. Hist., p. 154.
Strophonella punctulifera Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. XLIII, figs. 10-12.
Strophodonta punctulifera Walcott, 1884, U. S. Geol. Surv., Mon. VIII, p. 121, pl. 13, fig. 10.
Strophonella punctulifera Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, p. 292, pl. XII, figs. 10-12.
Strophonella cavumbona Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, pp. 291, 292.
Strophonella punctulifera Weller, 1903, Pal. N. J., vol. III, pp. 277, 301, pl. XXVII, figs. 6-8; pl. XXXIII, fig. 9.
Strophonella punctulifera Shimer, 1905, N. Y. State Mus., Bull. 80, p. 242.
Strophonella punctulifera Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 111, pl. 37, figs. 10, 11.
Strophonella punctulifera Clarke, 1909, N. Y. State Mus., Mem. 9, pt. 2, p. 45, pl. 9, figs. 16-18.
Strophonella punctulifera Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 323, pl. LIX, figs. 8-10.

Description—"Shell subsemicircular, about four-fifths as long as wide. Ventral valve concave; beak not projecting beyond the hinge. Dorsal valve concave near the umbo, very convex near the middle; beak not elevated above the cardinal margin; sides somewhat contracted below the extremities of the hinge. Hinge line straight, nearly

or quite equalling the greatest width of the shell, finely crenulated. Area narrow, linear, vertically striated. Foramen nearly closed, with a narrow prominent callosity along the centre. Surface marked by strong sharp striae, which increase by bifurcation and interstitial addition, becoming rapidly more numerous and finer towards the margins, and are distinctly punctate in the best preserved specimens.

"[Remarks] * * * * *

" * * * The striae, even in those scarcely exfoliated, are marked by one or two rows of elevated pustules, which are punctate at their extremities, and appear to be the bases of small tubular spines. This character, however, is very variable, and in some specimens obscure upon the surface of the shell, while it becomes conspicuous on the exfoliate specimens, and the casts are strongly punctate, while the interior of the shell is distinctly pustulose. * * * * *

—Hall, 1859.

Genus *Leptaenisca* Beecher

Leptaenisca concava (Hall)

Plate 47, figures 7-16

Leptaena concava Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 47.

Leptaena concava Hall, 1859, Pal. N. Y., vol. III, p. 197, pl. XVIII, figs. 2 a-f, 1861.

Leptaena? (*subgenus?*) *concava* Hall, 1883, Rept. State Geol. N. Y. for 1882, pl. XLVI, figs. 30, 31.

Leptaenisca concava Beecher, 1890, Am. Jour. Sci., 3rd ser., vol. XL, p. 238, pl. 9, figs. 1-5.

Leptaenisca concava Hall and Clarke, 1892, Pal. N. Y., vol. VIII, pt. I, p. 300, pl. XV, figs. 30, 31; pl. XVa, figs. 19-21.

Leptaenisca concava Clarke, 1909, N. Y. State Mus., Mem. 9, pt. 2, p. 46, pl. 10, figs. 7-11.

Leptaenisca concava Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 310, pl. LVII, figs. 2-5.

Description—"Shell concavo-convex, hemispherical. Ventral valve regularly convex; umbonial region prominent; cardinal margin rounding from the beak towards the lateral extremities. Dorsal valve deeply concave. Hinge line less than the greatest width of the shell. Area of ventral valve broad, that of dorsal valve linear. Foramen triangular, nearly closed above by a thick callosity, the lower part occupied by the prominent cardinal process of the opposite valve. Surface marked by very fine close radiating striae, each fifth or sixth one a little more prominent than those between; crossed by fine regular concentric wrinkles, producing a beautiful subcancellate appearance."—Hall, 1859.

Remarks—The relative width of the hinge line is determinable on but three of the eleven specimens observed. These have their greatest width along the hinge line. The ventral valves of the observed specimens are either flattened or depressed, medially, from the cicatrix to the anterior margin. The radiating and concentric costae which ornament the shells are wavy.

Hall and Clarke figure two ventral valves of *L. concava* from New York whose greatest width is along the hinge line.¹

Clarke says: "When Beecher described the genus *Leptaenisca* there was but one species known, the *L. concava* of the Helderbergian. We subsequently described as additional species from the same fauna two smaller forms, *L. adnascens* and *L. tangens* which then seemed to differ from the larger both in form, surface sculpture and degree of attachment or size of cicatrix. We have before us in the Dalhousie fauna shells which at maturity present the characters of *L. concava*; their deeply convex and concave shells, with a cicatrix well developed, the form arched but frequently distorted in growth and

¹Pal. N. Y., vol. VIII, pt. I, pl. XV, figs. 30, 31, 1892.

some of these present a median flattening or sinus pretty well defined on the earlier portions of the ventral valves though this disappears in later growth. This median depression is one of the differentials of the smaller species *L. tangens* and *L. adnascens* and may indicate the possibility that the latter represent miniature conditions of *L. concava*. The presence of *Leptaeniscia concava* in these beds is our first knowledge of the occurrence of the genus outside of the early Devonian of New York. The species are rare members of the Helderbergian fauna. At Dalhousie the shells are quite abundant."¹

Schuchert figures a ventral valve from Maryland which is depressed medially, and whose hinge line is less than the greatest width of the valve.²

Superfamily Pentameracea

Family Porambonitidae

Genus *Anastrophia* Hall

Anastrophia verneuili (Hall)

Plate 47, figures 17-21; plate 48, figures 1-9

Atrypa lacunosa Vanuxem (not Sowerby), 1842, Geol. N. Y., Rept. 3rd Dist., p. 117, fig. 3 and p. 119.

Pentamerus verneuili Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 104, figs. 1, 2.

Pentamerus verneuili Hall, 1859, Pal. N. Y., vol. III, p. 260, pl. XLVIII, figs. 1 a-i, k-p, r-v, x, y, 1861.

Pentamerus verneuili Billings, 1863, Geol. Canada, p. 957, fig. 453.

Anastrophia verneuili Miller, 1889, N. Am. Geol., Pal., p. 334.

Anastrophia verneuili Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, pp. 224, 225, pl. LXIII, figs. 31-38; pl. LXXXIV, figs. 43, 44, 1894.

Anastrophia verneuili Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 565.

Anastrophia verneuili Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 14.

Description—"Shell subglobose; transverse diameter generally greater than the height. Ventral valve nearly circular or transversely elliptical, more depressed than the opposite, having a distinct sinus, commencing near the beak and regularly widening and deepening to the front, where it terminates in a short truncated extension fitting into a corresponding depression in the front of the other valve; beak shorter than the opposite, perforated by a triangular or subcircular foramen, which is generally covered by the strongly gibbous incurved beak of the other valve. Dorsal valve very much elevated; beak extremely gibbous or ventricose, and strongly incurved. Surface marked by from twenty-four to thirty sharply angular elevated plications, which increase by interstitial addition and bifurcation; from four to six of the plications on the ventral valve usually occupy the sinus; while from five to eight of those on the dorsal valve are very slightly elevated, so as to form a flat rather indistinct mesial fold.

"[*Remarks*] * * * The larger valve is the dorsal, and bears the two internal septa; while the smaller valve, or that with the sinus, is the ventral valve, having the triangular cavity beneath the beak, with a perforation at the extremity, and the dental lamellae are produced into the elongated cavity * * * and which, from the thickening of the valve, is often affixed to the shell at its base without the intervention of the usual septum, which, when present, is a very subordinate feature. The dental lamellae are lobed on the outside * * * leaving a space for the interlocking of the septa or brachial lamellae of the opposite valve. The dorsal valve is marked by two converging septa, which extend scarcely more than one-third of the length of the shell, and terminate in a thickened ridge in the deepest part of the valve. From these

¹N. Y. State Mus., Mem. 9, pt. 2, p. 46, 1909.

²Md. Geol. Surv., L. Dev., pl. LVII, fig. 5, 1913.

laminae or septa, near their junction with the hinge line, originate two broad thin brachial plates

*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*

"In the young shells of this species, the dorsal valve is abruptly incurved; the beak of the ventral valve is nearly as high as the opposite, and has beneath it a distinct triangular foramen and an apparent area * * As the shell grows older, the beak of the opposite valve fills the foramen; and the notch in the beak is carried farther inwards as the shell thickens, so that in old shells the beak presents a somewhat circular perforation, which communicates below with the triangular cavity.

"In extremely young shells, there is no appearance of mesial sinus or elevation."—Hall, 1859.

Family Pentameridae

Genus *Gypidula* Hall

Gypidula multcostata Dunbar

Plate 48, figures 10-19

Gypidula multcostata Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 22.

Gypidula multcostata Dunbar, 1920, Trans. Conn. Acad. Arts and Sciences, vol. 23, p. 131, pl. III, figs. 12, 13.

Description—"Shell subtrigonal in outline. Ventral valve strongly convex and much larger than the dorsal. Its beak narrow and strongly arched, but not incurved over that of the opposite valve. The sides diverge regularly to their greatest width at about three-fourths to four-fifths the distance to the front of the shell, then round abruptly into the broad and very slightly emarginate anterior margin, so that the outline is almost an isosceles triangle. Dorsal valve transversely elliptical and gently convex. A broad but low flat fold occupies the median half of the ventral valve, becoming obsolete before reaching the beak, and a corresponding sinus is present on the dorsal valve. The fold and sinus bear each ten to twelve slender, sharp, angular plications separated by angular grooves of equal width, while the inner part of each lateral slope is marked by four or five obscure plications, of which the outer is the most indistinct. Beyond these, the lateral slopes are smooth. The spondylium in the ventral valve is similar to that of *G. coeymanensis*, but considerable variation may be noted in the development of the median septum which supports it. In some specimens the septum is strong and in a few entirely absent.

Dimensions—Length, 40 mm.; width, 40 mm.; thickness, about 25 mm.

Discussion—The species is readily distinguished from all other described ones by the large number and slenderness of its plications. It is most closely related to *G. coeymanensis*, but that species has fewer and much coarser plications and reaches its greatest width nearer its mid-length."—Dunbar, 1920.

Remarks—A description of the Missouri specimens follows:

Shell subtriangular in outline, anterior border emarginate, anterior line of junction of valves sinuate. Ventral valve more convex than dorsal valve, elevated medially from anterior margin posteriorly; beak prominent, incurved over that of dorsal valve. Dorsal valve depressed medially from anterior margin posteriorly; beak incurved, fills delthyrium. Surface ornamented with radiating plications that become less prominent on valves laterally, increase by bifurcation, and the more conspicuous of which extend almost, if not quite, to beaks, crossed by concentric growth lines. Medial elevation of ventral valve has 7 to 12 plications; medial sinus of dorsal valve has 7 to at least 9 plications.

Order Telotremata

Superfamily Rhynchonellacea

Family Rhynchonellidae

Genus Rhynchotrema Hall

Rhynchotrema formosa (Hall)

Plate 48, figures 20-22

Rhynchonella formosa Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 76, figs. 1-5.

Rhynchonella formosa Hall, 1859, Pal. N. Y., vol. III, p. 236, pl. XXXV, figs. 6 a-i, k-p, r-u, x, y, 1861.

Stenocisma formosa Hall, 1867, Pal. N. Y., vol. IV, pt. I, p. 334.

Stenochisma formosa Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, pp. 187-189; pl. LVI, figs. 41-45, 1894.

Rhynchotrema formosum Schuchert, 1897, U. S. Geol. Surv., Bull. 87, p. 369

Stenochisma formosa Shimer, 1905, N. Y. State Mus., Bull. 80, p. 245.

Stenochisma formosa Maynard, 1913, Md. Geol. Surv., L. Dev., p. 349, pl. LXII, figs. 25-29.

Description—"Shell subtriangular or transversely oval; lateral margins forming an angle at the beak of about 90 degrees to 110 degrees. Ventral valve somewhat more depressed than the opposite; beak prominent, arched, not strongly incurved. Dorsal valve larger, declining with a gentle curve towards the margins; beak incurved. Surface marked by twenty to twenty-four simple angular plications on each valve, from two to four of which in the middle are coarser and depressed in the ventral valve, having a corresponding number abruptly elevated upon the dorsal valve; concentrically marked by fine closely arranged striae."—Hall, 1859.

Remarks—But one specimen has been observed.

Genus Eatonia Hall

Eatonia singularis (Vanuxem)

Plate 49, figures 1, 2

Atrypa singularis Vanuxem, 1842, Geol. N. Y., Rept. 3rd Dist., p. 120, fig. 3.

Eatonia singularis Hall, 1859, Pal. N. Y. vol. III p. 243, pl. XXXVIII, figs. 14, 15 a, b, 16 a-c, 17 a-d, 18, 19 a, b, 20, 1861.

Eatonia singularis Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 206, pl. LXI, figs. 13-16, 1894.

Eatonis singularis Weller, 1903, Pal. N. J., vol. III, p. 311, pl. XXXVI, figs. 24-27.

Eatonia singularis Shimer, 1905, N. Y. State. Mus., Bull. 80, p. 245.

Eatonia singularis Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 371, pl. LXV, figs. 21, 22.

Description—"Shell wider than long, varying in form from ovate to transversely elliptical or rhomboidal; hinge line very slightly declining from the beaks. Ventral valve depressed convex in the middle towards the beak, and concave between the centre and the deflected margins; and below the middle, extended into a deep broad sinus, which is prolonged and turned upwards in front at right angles to the longitudinal direction of the shell; beak small, closely incurved. Dorsal valve convex, sometimes gibbous, and sloping abruptly to the margins; having a strong mesial fold beginning above the centre, and produced in a broad flattened and greatly elevated extension. Surface marked by fine radiating striae, which, in well-preserved specimens, are

crossed by much finer concentric striae; a single central one, and sometimes two or three of the striae upon the mesial sinus, are much stronger than the others; and there is sometimes an impressed line down the centre of the dorsal valve.

"[Remarks]—The inner margins of the shell are denticulate, but this character is not shown in well-preserved specimens; it is seen in the casts, and upon the edges of the shell when worn from the exterior."—Hall, 1859.

Remarks—Only one specimen has been observed.

Genus *Ucinulus* Bayle

Ucinulus nucleolatus (Hall)

Plate 49, figures 3-16

Rhynchonella nucleolata Hall, 1857 (in part), 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 68.

Rhynchonella nucleolata Hall, 1859 (in part), Pal. N. Y., vol. III, p. 227, pl. XXXI, figs. 2 f-i, k-p, r-u, x, y, (not figs. 1 a-c = *U. globulus*, 1 d-f and 2 a-e = *U. globulus*), 1861.

Rhynchonella nucleolata Billings, 1863, Proc. Portland Soc. Nat. Hist., p. 110, pl. 3, fig. 5.

Ucinulus nucleolata Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 199.

Ucinulus nucleolatus Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 564.

Ucinulus nucleolatus Weller, 1903, Pal. N. J., vol. III, p. 284, pl. XXIX, figs. 6-9.

Ucinulus nucleolatus Shimer, 1905, N. Y. State Mus., Bull. 80, p. 245.

Ucinulus nucleolatus Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 365, pl. LXIV, figs. 16, 17.

Description—"Shell varying from spherical to spheroid-pentagonal [this refers to the forms * * * * taken out and named *U. globulus*¹] or subpentagonal. Ventral valve convex or depressed convex, abruptly deflected towards the margins; beak small, depressed, closely incurved over that of the opposite valve, often subangular on its lateral margins. Dorsal valve larger, sometimes very gibbous, often a little depressed towards the beak; beak never prominent. Surface marked by fifteen to twenty-three simple rounded plications, about four or five of which are slightly elevated towards the front of the dorsal valve into a mesial prominence, and three to five depressed on the ventral valve, so as to form a more or less distinct sinus, which never extends beyond the middle of the shell. These depressions are prolonged in front into a more distinct linguiform extension fitting into a corresponding sinus in the front of the opposite valve, and sometimes curved inwards beyond the plane of a right angle with the back of the valve,"—Hall, 1859.

Remarks—The specimens at hand have from about 20 to about 34 plications on each valve, from 4 to 6 plications on the fold, and from 3 to 5 plications in the sinus,

Ucinulus mutabilis (Hall)

Plate 49, figures 17-22

Rhynchonella mutabilis Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 66, figs. 1-7.

Rhynchonella mutabilis Hall, 1859, Pal. N. Y., vol. III, p. 225, pl. XXIX, figs. 4 a-p; pl. XXX, figs. 1 a-e, 2 a-i, k-p, r, s, 1861.

Ucinulus mutabilis Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 199, pl. LVIII, figs. 22-25, 1894.

Ucinulus mutabilis Weller, 1903, Pal. N. J., vol. III, p. 283, pl. XXIX, figs. 1-5.

¹Schuchert, C., Md. Geol. Surv., L. Dev., p. 365, 1913.

Uncinulus mutabilis Clarke, 1908, N. Y. State Mus., Mem. 9, pt. I, p. 171, pl. 28, figs. 3-8.

Description—"Shell varying from ovate to spherical. Ventral valve sometimes depressed, generally most convex in the umbonal region; beak small, pointed, closely incurved over that of the opposite valve. Dorsal valve gibbous; beak incurved beyond the hinge line; cardinal border on each side of the beak, concave. Surface marked by twenty to twenty-six depressed rounded simple plications, of which about six or eight are slightly raised towards the front of the dorsal valve into an indistinct mesial elevation; and five or six depressed near the front of the ventral valve, and extended into a short linguiform prolongation; concentrically marked by fine undulating striae.

"[*Remarks*]-The plications on this shell are usually simple, though in a few specimens one or two of them are seen to bifurcate * * * the plications in front and at the sides are marked with a central impressed line towards the margins of the valves.

"In form and general aspect this species varies greatly, being sometimes longitudinally ovate or oblong, in others globose and subpentagonal. The extremes of these varieties, without the intermediate forms, would appear to present well-marked specific differences; but a careful study of the series shows such an imperceptible gradation of form as to leave no doubt of their identity.

"The cast of the ventral valve shows a strongly marked ovate muscular imprint, the details of which, and of the accessory parts, vary in individuals of different forms and proportions."—Hall, 1859.

Remarks—The observed specimens have from about 23 to about 38 plications on each valve, from 3 to 6 plications on the fold, and from 2 to 5 plications in the sinus. The surface of the valves is marked with concentric lines.

Uncinulus subpyramidatus n. sp.

Plate 49, figures 23-34

Description—Shell small, globose-subpyramidal in form, transversely subelliptical in outline. The dimensions of a complete example are: Length 9.7 mm., width 11.2 mm., thickness 8.9 mm., width of sinus 4.7 mm.

Pedicle valve depressed convex in the umbonal region, the surface a little inflected to the cardinal margin, curving to the antero-lateral margins with an increasing convexity as it approaches the margin; mesial sinus originating anterior to the beak, becoming moderately deep anteriorly and produced in front in a long lingual extension lying in nearly a right angle to the plane of the valve; the beak small, incurved over that of the brachial valve. Surface of the valve marked by simple, rounded plication, which become faint towards the beak, about three to about eight occupy each lateral slope of the valve, and one or two the mesial sinus, grooved longitudinally along their median line as they approach the anterior margin.

Brachial valve depressed convex in the umbonal region, the surface curving with a strong convexity as it approaches the antero-lateral margins, the mesial fold originating at, or anterior to, the beak, becoming moderately elevated in front, and curving rather abruptly to the anterior margin. Surface marked by plications similar to those of the pedicle valve, about three to about eight on each lateral slope, and two or three upon the mesial fold, grooved longitudinally.

Surface of both valves marked by concentric lines of growth.

Remarks—This little shell is less globular and more coarsely plicated than *U. globulus*.

It differs externally from the associated *Wilsonia wadei* in its less angular and more globose form, the margins of the valves not being abruptly deflected.

Genus *Wilsonia* Kayser*Wilsonia wadei* Dunbar

Plate 49, figures 35-48; plate 50, figures 1-4

Wilsonia wadei Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 8.*Wilsonia wadei* Dunbar, 1920, Trans. Conn. Acad. Arts and Sciences, vol. 23, p. 133, pl. III, figs. 3, 4.

Description—"Shell small, subglobular or subpentahedral in form; deepest and strongly truncate at the front margin; length, breadth and height about equal. Ventral valve depressed convex, but sharply deflected, almost angulated along the margins; beak short and small, neatly incurved. A mesial sinus begins about the middle of the valve and is produced anteriorly into a narrow linguiform extension that is sharply deflected at right angles to the plane of the valve. Dorsal valve about as deep as the ventral, also gently convex and steeply angulated at the margins. A fold on the anterior portion corresponds to the sinus of the opposite valve. The surface bears low rounded plications, of which one occupies the sinus, two the fold, and three each lateral slope. Rarely in large specimens there are two plications on the sinus and three on the fold. The plications become obsolescent near the beak.

"Internally the hinge plate in the dorsal valve bears a crural cavity as in *Camarotoechia*, and the cardinal process is wanting.

"*Dimensions*—Length, 9 mm.; width, 9 mm.; height, 8.5 mm. Of a large specimen: 11 mm., 10.5 mm. and 9.2 mm., respectively."—Dunbar, 1920.

Remarks—The Missouri representatives have from about 4 to about 7 plications on each lateral slope of each valve, 2 or 3 plications on the fold, and 1 or 2 in the sinus.

Genus *Rhynchonella* Fischer*Rhynchonella transversa* Hall

Plate 50, figures 5-20

Rhynchonella transversa Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 74, figs. 5, 6.*Rhynchonella transversa* Hall, 1859, Pal. N. Y., vol. III, p. 234, pl. XXXIV, figs. 9-16, 1861.*Rhynchonella transversa* Weller, 1903, Pal. N. J., vol. III, p. 283, pl. XXIX, figs. 28-31.

Description—"Shell subtriangular, wider than long, tapering abruptly to the beak. Ventral valve depressed convex, most prominent near the beak; beak arched. Dorsal valve a little larger, most elevated near the front; beak incurved; foramen narrow, continued up to the apex of the beak. Surface ornamented by about fourteen or fifteen sharply elevated plications on each valve, of which from three to four are elevated near the front into a rather faint mesial fold, and two or three depressed on the ventral valve so as to form a faint sinus in the front. Somewhat strong zigzag lines of growth mark the surface of the valves near the margin in front."—Hall, 1859.

Remarks—The specimens at hand have from 12 to 17 plications on each valve, from 3 to 4 on the fold, and from 2 to 3 in the sinus.

Rhynchonella (?) *bialveata* Hall

Plate 50, figures 21-24

Rhynchonella ? *bialveata* Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 73.*Rhynchonella* ? *bialveata* Hall, 1859, Pal. N. Y., vol. III, p. 233, pl. XXXIV, figs. 1-4, 1861.*Rhynchonella bialveata* Schuchert, 1897, U. S. Geol. Surv., Bull. 87, p. 355.

Rhynchonella bialveata Weller, 1903, Pal. N. J., vol. III, p. 327, pl. XLII, figs. 9, 10.
Rhynchonella (?) bialveata Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 377, pl. LXVI, fig. 4.

Camarotoechia bialveata Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 6.

Description—"Shell small, triangular or triangular-ovate, sometimes compressed. Valves nearly equally convex; beak of dorsal valve incurved; beak of ventral valve almost straight and subangular; foramen narrow triangular, and continued to the apex of the beak. Surface ornamented by from twelve to fourteen simple angular plications on each valve; the two central of which, on the dorsal valve, die out a little before reaching the beak, near which they are somewhat depressed, but towards the front they become slightly elevated above the others, so as to form an indistinct mesial prominence. The middle plication on the ventral valve is smaller than the others, and depressed near the front so as to produce a faint sinus, which extends about two-thirds of the way to the beak, at which point the valve is most convex. The two plications bordering the sinus are larger and more prominent than those on each side of them, and become obsolete before reaching the beak. A few faint imbricating lines of growth are visible near the junction of the valves in front."—Hall, 1859.

Superfamily Terebratulacea

Family Centronellidae

Genus *Rensselaerina* Dunbar

Rensselaerina medioplicata Dunbar

Plate 50, figures 25, 26

Rensselaerina medioplicata Dunbar, 1917, Am. Jour. Sci., vol. XLIII, pp. 466, 469, pl. II, figs. 1-9, 12-18.

Rensselaerina medioplicata Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, figs. 12, 13.

Description—"Shell decidedly elongate oval, often nearly cylindrical, but otherwise having the general form of the later *Rensselaerias*, though always less broad-shouldered. Shell substance very finely punctate. Of the exterior surface, the posterior half and the lateral slopes of the shell are entirely smooth; but anteriorly the median portion of both valves bears a few simple, rounded, conspicuous plications which become obsolete about half-way to the beaks. The plications are separated by well-defined concave interspaces that are at least as wide as the plications themselves. There is no cardinal area and the cardinal and lateral slopes are rounded. The sides of the shell are not incurved as in *Beuchia*, nor steeply angulated as is commonly the case in *Rensselaeria*. The minute beak of the dorsal valve is concealed by that of the ventral valve, which is strongly incurved and closely appressed; the pedicle foramen is minute and neither resorbed nor abraded through the umbo.

"The ventral interior differs from that of *Rensselaeria* in having very small vertical dental plates that do not attain the bottom of the valve, while the pedicle or rostral cavity between them is very deep and narrow. The muscle scar is limited to the posterior half of the shell. The diductor scars are elongate and slender. Between their more deeply impressed posterior portions are embraced the narrow imprints of the adductor muscles. The dorsal interior has a thick and conspicuous triangular hinge plate, supported by two thickened crural lamellae. This plate is highly variable. Most commonly it is thickened medially into a slight triangular elevation, the actual cardinal process * * on which are the scars of the cardinal muscles; but all gradations occur from such an elevation to a decided triangular pit * * for the insertion of these muscles, or to the other extreme where a distinct median process arises * * at the sides of which lie the muscle scars. This tendency toward elevation of the center of the hinge plate is in marked contrast with *Rensselaeria*,

wherein the plate is primitively flat but in later forms always has a depressed cardinal pit. As in most lower Devonian terebratulids, the hinge plate is transversed by a well defined visceral foramen, which, beginning dorsal of the anterior edge of the plate, emerges on its surface just below the beak. The adductor muscle scars are narrow, separate and distinctly impressed. * * * *

"Shell with the characters of the genus; length of a mature individual 24 mm., width 14 mm., thickness 11 mm. Six to eight plications on the middle of the ventral valve and one more on the dorsal. About three of these plications in a width of 5 mm., on the anterior margin. Hinge plate extremely variable, being in some specimens excavate, in others raised into a median process."—Dunbar, 1917.

Remarks—A single specimen has been observed.

Rensselaerina medioplicata var. *latior* Dunbar?

Plate 53, figures 21-24; plate 54, figures 1-4

Rensselaerina medioplicata var. *latior* Dunbar, 1917, Am. Jour. Sci., vol. XLIII, p. 469, pl. II, figs. 10, 11.

Description—" * * a shell like *R. medioplicata* but proportionally much broader and shorter, and with the plications finer and somewhat more restricted to the anterior part of the shell. The length of a fully grown specimen is 20 mm., breadth 16 mm., thickness 11 mm. There are four plications in about the width of three in *R. medioplicata*."—Dunbar, 1917.

Remarks—The specimens—more or less of the anterior portion of the shell is missing—show no trace of plications.

Superfamily Spiriferacea

Family Atrypidae

Genus *Atrypina* Hall and Clarke

Atrypina imbricata (Hall)

Plate 50, figures 27-29

Leptocoelia imbricata Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 108.
Leptocoelia imbricata Hall, 1859, Pal. N. Y., vol. III, p. 246, pl. XXXVIII, figs. 8-13, 1861.

Leptocoelia imbricata Billings, 1863, Geol. Canada, p. 957, fig. 452.

Trematospira imbricata Hall, 1863, Trans. Albany Inst., vol. IV, p. 146.

Trematospira imbricata Hall, 1863, 16th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 60.

Trematospira ? imbricata Meek and Worthen, 1868, Ill. Geol. Surv., vol. III, p. 381, pl. 7, figs. 2 a-e.

Atrypina imbricata Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 162, pl. LIII, figs. 5, 6, 8-10, 1894.

Trematospira imbricata ? Keyes, 1894, Mo. Geol. Surv., vol. V, p. 96.

Atrypina imbricata Weller, 1903, Pal. N. J., vol. III, p. 312, pl. XXXVII, figs. 17-22.

Atrypina imbricata Shimer, 1905, N. Y. State Mus., bull. 80, p. 246.

Atrypina imbricata Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 109.

Atrypina imbricata Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 394, pl. LXXVIII, figs. 4-6.

Atrypina imbricata Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 2.

Description—"Shell longitudinally semi-elliptical or suborbicular. Ventral valve convex, most prominent along the middle, and sloping laterally; beak small, incurved at the apex and perforated by a very small round aperture, one side of which is formed

by the deltidium. Dorsal valve flattened or depressed convex; beak scarcely elevated above the hinge; hinge line sloping from the beaks at an angle of about 150 degrees, rounded at the extremities, nearly equal to the greatest width of the shell; false area narrow, much shorter than the hinge. Surface marked by ten to twelve plications on each valve, of which two on the middle of the ventral valve are larger and more elevated than the others, and separated by a wider and deeper depression than between those on each side. The central plication on the dorsal valve is larger than the others—near the front, but usually dies out before reaching the beak. Shell marked by strong imbricating concentric lamellae of growth.”—Hall, 1859.

Remarks—The observed specimen has 6 plications on each valve. The depression between the two central plications of the ventral valve is narrower than the depressions that bound them. The central plication of the dorsal valve is depressed, is narrower than the plication on each side of it, and does not attain the beak of the valve.

Genus *Atrypa* Dalman

Atrypa reticularis (Linne)

Plate 50, figures 30-40

Anomia reticularis Linne, 1767, *Systema Naturea*, ed. XII, I, p. 1132.

Atrypa reticularis Hall, 1852, *Pal. N. Y.*, vol. II, p. 72, pl. XXIII, fig. 8; p. 270, pl. LV, fig. 5.

Atrypa reticularis Hall, 1859, *Pal. N. Y.*, vol. III, p. 253, pl. XLII, figs. 1 a-r, 1861.

Atrypa reticularis Keyes, 1894, *Mo. Geol. Surv.*, vol. V, p. 97, pl. XLI, figs. 13a, b.¹

Atrypa reticularis Girty, 1899, *U. S. Geol. Surv.*, 19th Ann. Rept., pt. III, p. 565.

Atrypa reticularis Weller, 1903, *Pal. N. J.*, vol. III, pp. 236, 286, pl. XXI, figs. 35-37; pl. XXX, figs. 11-18.

Atrypa reticularis Shimer, 1905, *N. Y. State Mus.*, Bull. 80, p. 246.

Atrypa reticularis Clarke, 1908, *N. Y. State Mus.*, Mem. 9, pt. 1, p. 109.

Atrypa reticularis Clarke, 1909, *N. Y. State Mus.*, Mem. 9, pt. 2, pp. 42, 81.

Atrypa reticularis Maynard, 1913, *Md. Geol. Surv.*, L. Dev., p. 392, pl. LXVII, figs. 26-28.

Description—“Shell subrotund, more or less compressed, subtruncated above or on the hinge line; valves more or less equal, the beak of the dorsal [ventral] valve extending beyond the ventral [dorsal] valve, and the latter being deeper and more convex in older specimens; surface marked by dichotomous rounded striae, which are crossed by concentric elevated lamellae, giving a reticulated or decussated character to the surface.

“It is impossible to give a definite description of this very protean species, which commences its existence in the Clinton group, and continues under various modifications through the succeeding strata as far as the Chemung group. In each of its geological positions, however, it presents peculiar characters, and we are able to decide at once the geological position of specimens, by these peculiarities. * * * *

* * * * —Hall, 1852.

Remarks—The variations exhibited by the representatives at hand from the Missouri Helderberg are shown by the specimens figured.

¹See Schuchert, C., *U. S. Geol. Surv.*, Bull. 87, pp. 154-155, 1897, for complete bibliography to 1897.

Family Spiriferidae

Genus *Delthyris* Dalman*Delthyris perlamellosus* (Hall)

Plate 50, figures 41-49.

Spirifer perlamellosus Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 57; figs. 1-5.

Delthyris macropleura Rogers (not Conrad), 1858, Geol. Penn., vol. II, pt. II, p. 825, fig. 643.

Spirifer perlamellosus Hall, 1859, Pal. N. Y., vol. III, p. 201, pl. XXVI, figs. 1a-i, k-p, r-t, 2a-g, 1861.¹

Description—"Shell trigonal or semi-circular, more or less extended on the hinge line, the extremities varying from obtuse or rounded to extremely mucronate. Ventral valve arcuate, the beak much extended beyond the opposite valve, and incurved at the apex; sinus deep, gradually expanding, and produced in front into a linguiform extension. Dorsal valve convex towards the middle, the mesial elevation very prominent, and the beak closely incurved against the area, or partially closing the foramen of the ventral valve. Area moderately wide, frequently much expanded, and becoming linear towards the extremities when the shell is much extended. Surface marked by four to six strong and abruptly elevated plications on each side of the mesial sinus and elevation, concentrically marked by strong imbricating lamellae, which are abruptly arched in passing over the plications, giving an extreme roughness to the surface. In well-preserved specimens, finer longitudinal striae mark the surface of these lamellae. In ordinary specimens, the concentric lamellae are more closely arranged and more distinctly imbricate towards the margin; while near the beaks they are more distant, and are scarcely imbricate."—Hall, 1859.

Remarks—The Missouri specimens have 3 or 4 plications on each side of the medial fold and sinus.

Delthyris missouriensis n. sp.

Plate 51, figures 1-11

Description—This species differs from *D. perlamellosus* in that the ventral cardinal area is perpendicular, or nearly so, to the plane of junction of the valves and is relatively broader, and the beaks of the valves are of about equal height.

The plications on each side of the medial fold and sinus vary from 3 to at least 6.

Delthyris octocostatus (Hall)?

Plate 51, figures 28, 29

Spirifer octocostatus Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 62.

Spirifer octocostatus Hall, 1859, Pal. N. Y., vol. III, p. 205, pl. XXVIII, figs. 4a-e, 1861.

Spirifer octocostatus Weller, 1903, Pal. N. J., vol. III, pl. 288, pl. XXX, figs. 5-8.

Spirifer octocostatus Maynard, 1913, Md. Geol. Surv., L. Dev., p. 401, pl. LXVIII, figs. 25-29.

Description—"Shell subglobose; valves nearly equally convex. Ventral valve most elevated near the beak; sinus angular, extending to the apex; beak slightly incurved. Dorsal valve most convex in the middle; mesial elevation not prominent; beak rising little above the hinge line, slightly incurved; hinge line less than the width of the shell, rounded at the extremities. Area triangular, faintly defined, somewhat arcuate. Foramen narrow; a strong medium septum dividing the muscular area, and extending to the apex of the foramen. Surface having about four rounded moderately prominent

folds on each side of the mesial sinus and elevation, which become obsolete towards the beaks; concentrically marked by fine, regular, closely arranged, imbricating lamellose striae."—Hall, 1859.

Remarks—A small individual which has 3 plications on each side of the fold and sinus is doubtfully referred to this species.

Genus *Spirifer* Sowerby

Spirifer cyclopterus Hall

Plate 51, figures 12-27

- Spirifer cycloptera* Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 58.
Spirifer cyclopterus Hall, 1859, Pal. N. Y., vol. III, p. 199, pl. XXV, figs. 1a-z, 1861.
Spirifera cycloptera Billings, 1863, Geol. Canada, p. 957, fig. 457.
Spirifera cycloptera Billings, 1874, Pal. Fossils, vol. II, p. 48, pl. 3a, fig. 4.
Spirifera cycloptera Hall, 1883, 2nd Ann. Rept. N. Y. State Geol., pl. LXI, figs. 12, 13.
Spirifer cyclopterus Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 36, pl. XXXVI, figs. 12, 15, 1894.
Spirifer cyclopterus Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 565.
Spirifer cyclopterus Weller, 1903, Pal. N. J., vol. III, pp. 287, 314, pl. XXX, fig. 2; pl. XXXVIII, figs. 1-6.
Spirifer cyclopterus Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 178, pl. 32, figs. 14-21.
Spirifer cyclopterus Clarke, 1909, N. Y. State Mus., Mem. 9, pt. 2, p. 84.
Spirifer cyclopterus Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 406, pl. LXIX, figs. 8-10.

Description—"Shell semi-circular; extremities of the hinge line more or less symmetrically rounded. Ventral valve gibbous; beak elevated, more or less incurved; sinus moderately deep, curved on the sides and nearly flat in the middle. Dorsal valve very convex towards the middle, the mesial fold abruptly elevated and very prominent; beak little elevated above the hinge line, and scarcely incurved. Area moderate, scarcely extending to the extremity of the hinge line. Foramen large. Surface marked by five to seven rounded plications on each side of the mesial line, concentrically marked by fine close imbricating lamellose striae, which are more or less prominent, depending on the condition of preservation in the shell; surface of lamellae ornamented by short fine vertical striae or crenulations, which project in fimbriae on the edge of the lamellae.

"[*Remarks*]"—This species presents comparatively little variety in form; though there are, rarely, to be found individuals with the cardinal extremities much extended * * and others where the extremities are subangular * * * The greater number, however, are rounded * * *

" * * * The muscular impressions of the ventral valve are very deep and strong, the margins of the foramen terminating in prominent teeth. * *

—Hall, 1859.

Remarks—The Missouri specimens have the medial fold of the dorsal valve shallowly depressed medially from the anterior margin posteriorly; and have from 5 to at least 8 plications on each side of the medial fold and sinus.

Family Suessiidae

Genus *Cyrtina* Davidson

Cyrtina dalmani (Hall)

Plate 51, figures 30, 31; plate 52, figures 1-4

- Cyrtia dalmani* Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 64.
Cyrtia dalmani Hall, 1859, Pal. N. Y., vol. III, p. 206, pl. XXIV, figs. 2a-y, 1861.

Cyrtina dalmani Meek and Worthen, 1868, Ill. Geol. Surv., vol. III, p. 383, pl. 7, figs. 3a, b.

Cyrtina dalmani Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 46.

Description—"Shell trigonal; valves extremely unequal. Ventral valve triangularly pyramidal. Dorsal valve semi-circular; mesial lobe flat, or with a slightly depressed line; beak scarcely defined, or rising above the hinge line. Hinge line straight. Area triangular, flat or slightly arcuate. Foramen narrow, linear, usually closed in the lower part, with a semitubular opening above; concentric labellae strong, and often very conspicuous near the margin. Surface granulose-punctate."—Hall, 1859.

Remarks—The observed specimens have 3 or 4 plications on each side of the medial fold and sinus.

Family Rhynchospiridae

Genus Rhynchospira Hall

Rhynchospira formosa Hall

Plate 52, figures 5-18

Waldheimia formosa Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 88

Trematospira formosa Hall, 1859, Pal. N. Y., vol. III, p. 215, pl. XXXVI, figs. 2a-i, k-p, r-u, 1861.

Rhynchospira formosa Hall, 1859, Pal. N. Y., vol. III, p. 485, pl. XCVa, figs. 7-11, 1861.

Rhynchospira formosa Hall, 1867, Pal. N. Y., vol. IV, pt. I, p. 278, figs. 1-6.

Retzia formosa Miller, 1889, N. Am. Geol., Pal., p. 366.

Retzia formosa Whitfield, 1891, Ann. N. Y. Acad. Sci., vol. V, p. 512, pl. 5, figs. 15, 16.

Rhynchospira formosa Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 109, fig. 101; pl. L, figs. 21-25, 1894.

Retzia formosa Whitfield, 1895, Geol. Ohio, vol. VII, p. 413, pl. I, figs. 15, 16.

Rhynchospira formosa Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 566.

Rhynchospira formosa Weller, 1903, Pal. N. J., vol. III, p. 289, pl. XXXI, figs. 9-11.

Rhynchospira formosa Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 109.

Rhynchospira formosa Maynard, 1913, Md. Geol. Surv., L. Dev., p. 246, pl. LXXII, figs. 26-30.

Description—"Shell longitudinally ovate. Ventral valve tapering towards the beak; beak prominent rounded, arched or incurved, truncated at the apex by a round perforation, one side of which is formed by the deltidium. Dorsal valve gibbous, sometimes most prominent near the umbo; beak closely incurved beneath the opposite one. Surface marked by eighteen to twenty-two or twenty-three simple rounded or rarely sub-angular plications, two or three of which are much smaller and slightly depressed on the middle of each valve, so as to form a faint narrow sinus extending nearly or quite to the apex of the beaks, and giving a slight emarginate outline to the front. Surface marked by fine imbricating concentric lines of growth, which become strong lamellae towards the margins of the shell; shell granulose."—Hall, 1859.

Remarks—The specimens at hand have from 16 to 23 plications on each valve.

Genus Trematospira Hall

Trematospira equistriata Hall and Clarke

Plate 52, figures 19, 20

Trematospira equistriata Hall and Clarke, 1894, Pal. N. Y., vol. VIII, pt. II, pl. XLIX, fig. 47.

Trematospira equistriata Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 430, pl. LXXIII, figs. 8, 9.

Description—This species is represented by an incomplete shell whose surface is marked with regular, simple plications of which there are 6 in the sinus, and about 23 on each side of the sinus which is well-defined—the fold on the dorsal valve is indistinct.

Family Meristellidae

Genus *Nucleospira* Hall

Nucleospira ventricosa Hall

Plate 52, figures 21-33

Spirifer ventricosa Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 57.

Nucleospira ventricosa Hall, 1859, Pal. N. Y., vol. III, p. 220, pl. XIV, figs. 1a-h; pl. XXVIIIb, figs. 2-9, 14, 1861.

Nucleospira ventricosa Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, p. 145, figs. 128-130; pl. XLVIII, figs. 2-6, 18; pl. LXXXIV, figs. 39, 40, 1894.

Nucleospira ventricosa Weller, 1903, Pal. N. J., vol. III, pp. 290, 316, pl. XXX, figs. 19-22; pl. XXXVII, fig. 16.

Nucleospira ventricosa Shimer, 1905, N. Y. State Mus., Bull. 80, p. 255.

Nucleospira ventricosa Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 110.

Nucleospira ventricosa Schuchert, 1913, Md. Geol. Surv., L. Dev., p. 430, pl. LXXXIII, figs. 10-12.

Description—"Shell globose; valves almost equally convex. Ventral valve having a narrow sinus extending down the centre from beak to base; beak projecting above the other, strongly incurved and pointed (in many specimens the beaks are nearly equal). Dorsal valve having a central depressed line, which is less conspicuous than in the opposite valve; false area very small, concave. Surface marked by concentric lines of growth; and, when perfect, covered with minute hair-like spines, which, when removed, leave a punctate surface

"[Remarks]—The interior of the dorsal valve shows a faintly defined muscular area, a longitudinal septum, and prominent recurved cardinal process, with an accessory process on each side for the attachment of the spires. The ventral valve shows a longitudinal septum similar to that of the opposite valve, with a more or less strongly defined muscular depression; area, or false area, a concave triangular space, over which the acute beak is arched. In well-preserved specimens, the beak appears to be minutely perforate upon the under side. Internal spires * * * * showing ten or twelve turns on each side. * * * *

* * * * —Hall, 1859.

Genus *Meristella* Hall

Meristella laevis (Vanuxem)

Plate 52, figures 34-44; plate 53, figures 1, 2

Atrypa laevis Vanuxem, 1842, Geol. N. Y., Rept. 3rd Dist., p. 120, fig. 2.

Merista laevis Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 94, figs. 1-6.

Atrypa laevis Rogers, 1858, Geol. Penn., vol. II, pt. II, p. 825, fig. 642.

Merista laevis Hall, 1859, Pal. N. Y., vol. III, p. 247, pl. XXXIX, figs. 3, 4, 1861.

Meristella laevis Whitfield, 1891, Ann. N. Y. Acad. Sci., vol. V, p. 510, pl. 5, figs. 6, 7.

Meristella laevis Hall and Clarke, 1893, Pal. N. Y., vol. VIII, pt. II, pp. 75-78, pl. XLIII, figs. 3-6; pl. XLIV, fig. 4, 1894.

Meristella laevis Keyes, 1894, Mo. Geol. Surv., vol. V, p. 104.

Meristella laevis Whitfield, 1895, Geol. Ohio, vol. VII, p. 411, pl. I, figs. 6, 7.

Meristella laevis Weller, 1903, Pal. N. J., vol. III, pp. 290, 317, pl. XXXI, figs. 1-8; pl. XXXVIII, figs. 11-18.

Meristella laevis Shimer, 1905, N. Y. State Mus., Bull. 80, p. 255.

Meristella laevis Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 110.

Description—"Shell ovate, thin, somewhat ventricose. Ventral valve the larger, most gibbous in the centre and umbonial region, having a shallow mesial sinus extending from the front more than half way to the umbo; beak prominent, ventricose, incurved, not perforate. Dorsal valve regularly convex, gibbous in the middle, but without a defined mesial fold; beak incurved. Surface smooth, or marked by obscure concentric lines and occasional stronger concentric wrinkles of growth, and, in the exfoliated shell, by obscure radiating striae."—Hall, 1859.

Meristella bella Hall

Plate 53, figures 3-6

Merista bella Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 92, figs. 1, 3-7.

Merista bella Hall, 1859, Pal. N. Y., vol. III, p. 248, pl. XL, figs. 1a-i, k-p, *Merista* (= *Meristella*) *bella*, 1861.

Meristella bella Whitfield, 1891, Ann. N. Y. Acad. Sci., vol. V, p. 510, pl. V, figs. 8-10.

Meristella bella Hall and Clarke, 1894, Pal. N. Y., vol. VIII, pt. II, pl. XLIII, figs. 7-9; pl. XLIV, figs. 1-3.

Meristella bella Whitfield, 1895, Geol. Ohio, vol. VII, p. 412, pl. I, figs. 8-10.

Description—"Shell varying from suborbicular or subquadrilateral to transversely oval, usually somewhat broader than long, gibbous. Ventral valve a little the larger, most convex near the umbo; beak prominent and closely incurved. Dorsal valve convex, gibbous in the middle and towards the umbo; both valves marked with a small sublinear mesial sinus, that of the ventral valve stronger than the other, the two often giving a distinct emarginate outline to the front. Surface smooth, or marked by faint concentric lines of growth, with much fainter indications of radiating striae.

"[Remarks] * * * * The sinus on the front of the ventral valve is always broader and deeper than that on the other, giving a waved outline to the margins of the valves. * * * * *

* * * * * —Hall, 1859.

Remarks—But one specimen has been observed.

Meristella princeps Hall

Plate 44, figures 9-11

Merista princeps Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 95, figs. 1-5.

Merista princeps Hall, 1859, Pal. N. Y., vol. III, p. 251, pl. XLIV, figs. 1a-b, 2a-b, 3a-c, 4a-h, 5 a-d, *Merista* (= *Meristella* ?) *princeps*, 1861.

Camarium princeps Hall, 1859, Pal. N. Y., vol. III, p. 486.

Meristella princeps Hall, 1860, 13th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 93, figs. 5-7.

Meristella princeps Hall and Clarke, 1894, Pal. N. Y., vol. VIII, pt. II, pl. XLIII, figs. 10-13.

Meristella princeps Shimer, 1905, N. Y. State Mus., Bull. 80, p. 255.

Meristella princeps Clarke, 1909, N. Y. State Mus., Mem. 9, pt. 2, p. 41.

Description—"Shell ovate; sides sloping towards the beaks at an angle of about 60 degrees. Ventral valve more or less profoundly arcuate longitudinally, most ventricose near the central and umbonial region, depressed below and having a broad shallow flat or subangular mesial sinus in front, terminating (in old specimens) in a linguiform extension which is bent upwards at right angles to the longitudinal plane of the shell; beak strongly incurved. Dorsal valve gibbous and extremely elevated along the middle, which becomes in front a strong rounded mesial elevation; sides of the valve declining

very abruptly to the baso-lateral margins; beak closely incurved beneath that of the opposite valve. Surface marked by obscure fine radiating striae, which are crossed by indistinct concentric lines of growth; the latter often becoming conspicuous towards the margins.

"[Remarks]—This * * * * species differs considerably in the form and depth of the mesial sinus * * *. In some of the specimens the sinus is very shallow and flattened within, while in other instances it is more impressed and angular in the middle; other specimens present intermediate grades of difference in this respect, the sinus being nearly flat within, and marked by a narrow, nearly linear, deeper depression along its middle * * * * *"

—Hall, 1859.

Remarks—This species is represented by a single, incomplete shell.

Meristella atoka Girty

Plate 53, figures 7-20

Meristella arcuata var. *atoka* Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III p. 567, pl. LXXI, figs. 1a-f.

Meristella atoka Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 1, fig. 11; pl. 2, fig. 3.

Description—"Shell rather small, subtriangular; width slightly greater than the length.

"Umbo of the ventral valve full; beak small and strongly incurved; sinus strongly marked, beginning above the middle of the shell as a depressed line, deepening and broadening as growth advances, but never losing its angular character, the upturning of the sinus towards the front and the angularity so pronounced as often to make a distinct emargination in the anterior outline, which would otherwise be well rounded. Young examples are subcircular, but usually with a faint angular sinuation, noticeable in the two valves as seen from the front.

"From this type, by gradations, considerable variations are found. The fold varies both in strength and shape, and specimens occur in which this feature is high and rounded as well as high and angular, and others in which it is low and rounded and low and angular. But generally it is both angular and well marked. Similarly the shape varies from being wider than long to being longer than wide, the beak of the ventral valve in that case being higher and more projecting. Perhaps several specific names might be employed for the extremes of variation, but I do not believe that these distinctions would be justified * * * * *

—Girty, 1899

Remarks—A description of the Missouri representatives follows:

Shell subtriangular to subpentagonal in outline, anterior border emarginate. Ventral valve longitudinally arcuate, medial anterior portion prolonged dorsally; marked, medially, from anterior margin posteriorly with prominent, subangular sinus; beak incurved over that of dorsal valve. Dorsal valve marked, medially, from anterior margin posteriorly with prominent, rounded fold; beak incurved. Surface ornamented with radiate costae—4 in 1 mm. near anterior border of shell—crossed by concentric growth lines.

MOLLUSCA

Class PELECYPODA

ORDER PRIONODESMACEA

Superfamily Pteriacea

Family Pteriidae

Genus *Pteronitella* Billings*Pteronitella* sp.

Plate 54, figure 5

Description—An internal cast of a portion of a left valve—with extended posterior extremity, and marked at least with concentric lines and wrinkles—is doubtfully assigned to this genus.

Family Conocardiidae

Genus *Conocardium* Bronn*Conocardium* sp.

Plate 54, figure 6

Description—This genus is represented by an internal cast of a part of a left valve

Superfamily Pectinacea

Family Pectinidae

Genus *Aviculopecten* M'Coy*Aviculopecten* ? *umbonata* (Hall)?

Plate 54, figures 7, 8

Avicula umbonata Hall, 1859, Pal. N. Y., vol. III. p. 284, pl. LI, fig. 6, 1861.

Description—"Shell rhomboid, nearly once and a half as long as high; anterior margin broadly rounded; posterior side narrower and acutely rounded, very convex in the middle and upon the umbo; anterior wing small, acute, extending a little beyond the anterior margin of the shell, and separated from the body of the shell by a narrow well-marked sinus; posterior wing larger, separated from the body of the shell by a broad defined sinus. Surface marked by concentric lamellose striae, which are closely crowded on the wings.

"[*Remarks*]—The specimen has nearly all the shell exfoliated, and the small portion remaining is somewhat imperfect, the cast retaining the impressions of the lamellose striae"—Hall, 1859

Remarks—Doubtfully included here are two portions—the greater part of one is exfoliated—of left valves, and an internal cast of a part of a left valve

In addition to the concentric lines of Hall's specimen, they show concentric wrinkles; and the specimen that best exhibits the shell surface shows two faint, radial ribs.

Order Teleodesmacea

Superfamily Cypricardiacea

Family Pleurophoridae

Genus *Cypricardinia* Hall*Cypricardinia distincta* Billings?

Plate 54, figure 9

Cypricardinia distincta Billings, 1874, Pal Fossils, vol. II, pt. I, p. 56, figs. 26, 27.*Cypricardinia distincta* Clarke, 1908, N. Y. State Mus., Mem. 9, pt. I, p. 157, pl. 24, figs. 12-19.

Description—"Under this name the author cited and illustrated the two extremes of variation in this species, one elongate with broad and few growth bands and the umbonal ridge suppressed probably by compression, the other more rhomboidal in outline, with narrower, more numerous growth bands, sharper umbonal ridge and more sinuous postlateral margin. In the absence of intermediate forms these might be regarded so unlike as to be terms of parallel rather than continuous series.

"*Original description*—Shell oblong or irregularly ovate; compressed or moderately convex; an oblique, obscure angulation extending from the umbones to the posterior angle; umbones sometimes slightly flattened by an obscure depression which descends, gradually widening, to the ventral margin; beak small, closely incurved. Dorsal margin straight, slightly concave or convex, parallel with the ventral margin or a little elevated posteriorly, usually about one-fourth shorter than the total length. Ventral margin usually gently concave, but sometimes straight or slightly convex. Anterior extremity usually with the lower half a little projecting and rounded, concave, at the mid-height or obtusely rounded; posterior extremity, with the most projecting point at the mid-height or a little below, narrowly rounded or angular; the upper half obliquely truncated with a straight or gently convex slope.

"The largest specimen collected is seventeen lines in length, eight lines in height at the umbones, and nine lines high at the posterior end of the hinge line. All the others are shorter and proportionally higher. In several specimens which have both valves in connection, the right valve is the most convex."

"The surface of the broad growth rings is usually marked by very fine concentric lines and with good preservation the umbonal slope presents a series of fine radial and interesting surface lines which are sometimes exhibited from the hinge line as far as the middle of the basal margin. *Cypricardinia distincta* is one of the largest forms of the genus and is unlike the species known to us from the Oriskany fauna. It approaches more nearly the species *C. sublamellose* and *C. carassa* Hall of the New Scotland (Helderbergian) beds of New York. We find these shells to be quite common in the limestones [Grande Greve]."—Clarke, 1908.

Remarks—This form is possibly represented by an incomplete left valve.

MOLLUSCA

Class GASTROPODA

Subclass Streptoneura

Order Ctenobranchiata

Suborder Platypoda

Superfamily Taenioglossa

Family Capulidae

Genus *Platyceras* Conrad*Platyceras pentalobus* Hall

Plate 54, figures 10-20

Platyceras pentalobus Hall, 1859, Pal. N. Y., vol. III, p. 319, pl. LVIII, figs. 7a-c, 1861.

Description—"Shell obliquely subconical; spiral with about two volutions; apex and upper volution smooth and rounded, becoming plicate on the last volution; plications four, five or more; peristome simple. Surface marked by fine transverse striae, which are strongly undulated in passing over the plications.

"[*Remarks*]-I have not been able to trace this species through its gradations of form; but it is so different from the other species observed, that I can have no doubt of its specific distinctness."—Hall, 1859.

Remarks—The Missouri specimens referred to *P. pentalobus* present a gradational variation as follows: Apex above to below upper surface of body whorl; whorls about $1\frac{1}{2}$ to about 3, all contiguous to part of body whorl free; lower surface of body whorl flattened to rounded; upper surface of body whorl rounded to subangular to flattened.

Dimensions—Range in size of shells indicated by figured specimens.

Platyceras sp.

Plate 54, figures 21, 22

Description—Single specimen with about 2 contiguous whorls, apex below upper surface of body whorl, body whorl with median ridge; peristome incomplete, upper portion with shallow sinus, outer lip with deep sinus, character of lower portion undeterminable; surface marked with undulating growth lines.

Remarks—This shell resembles *P. tenuiliratum* Hall¹ but the apex is below the upper surface of the body whorl, and the outer lip is deeply sinuate.

Platyceras ? sp.

Plate 54, figures 23, 24

Description—A portion of a whorl is doubtfully referred to this genus.

Genus *Diaphorostoma* Fisher*Diaphorostoma* sp.

Plate 54, figures 25, 26

Description—The specimen is an internal cast of a shell of about $2\frac{1}{2}$ whorls which resembles *D. depressum* (Hall)² but is smaller.

¹Pal. N. Y., vol. III, p. 317, pl. LVIU, figs. 1-5; pl. LIX, figs. 6a, b, 1859, 1861.

²Pal. N. Y., vol. III, p. 301, pl. LV, figs. 4a, b., 1859, 1861.

ARTHROPODA

Class CRUSTACEA

Subclass Trilobita

Order Opisthoparia

Family Goldiidae

Genus *Goldius* de Koninck*Goldius barrandii* Hall¹

Plate 54, figures 27

Bronteus barrandi Hall, 1859, Pal. N. Y., vol. III, p. 350, pl. LXXIII, figs. 1-4, 1861.*Bronteus canadensis* Logan, 1863, Geol. Canada, p. 391.*Bronteus barrandii* Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, p. 104, pl. 9, figs. 12, 13.

Description—"Pygidium semi-elliptical; line of articulation straight; rudiment of the axis abruptly prominent, nearly twice as wide at its upper edge as the length, showing two articulations. Surface around the axis nearly plane, and thence sloping more abruptly, and again becoming nearly flat at the margin; marked by seven ribs on each side the median lobe, which is wider than the lateral ones and gradually narrowing from the base of the axis for one-fifth of its length, below which it gradually expands towards the border without bifurcating; its surface scarcely more prominent than the lateral ribs, and the furrows limiting it not more profound than the adjacent ones; lateral ribs narrow at their origin and gradually expanding towards the margin, the upper one wider at its wider extremity than either of the others. Surface marked by undulating lamellose striae, which are arched upward on the ribs; intermediate spaces covered by fine granulations."—Hall, 1859.

Remarks—Clarke notes:² "This species is one of the rarest in the fauna of the New Scotland beds (Helderbergian) in eastern New York and has not been elsewhere found save at the locality here considered. The description was based on a series of pygidia only but the writer has collected the other parts so that the species is pretty well understood. All New York specimens of the pygidia are of uniformly small size, bear an entire and spineless margin, a broad flat median rib with seven narrow and subequal ribs on each side. We have a single pygidium agreeing with these New York specimens in all details even to size, obtained by me in the St. Alban beds [which 'present a congeries of 51 species of which fully one-half occurs in the typical Helderbergian faunas (Coeymans of New Scotland) to the southwest.'³] in Cape Rosier Cove [Gaspe].

"The name used by Logan as above cited doubtless has reference to this species. We elsewhere note the presence of a large varietal expression of *B. barrandii* in the fauna of Stewart's Cove, Dalhousie."

Goldius barrandii is represented in the Missouri material at hand by a part of a pygidium.

The pygidium was about 15 mm. long, and about 24 mm. wide; that figured by Hall is 12.5 mm. long, and 17 mm. wide; and that figured by Clarke is 9 mm. long, and 12.3 mm. wide.

¹"The family name 'Bronteidae' cannot be retained, as de Koninck's term *Goldius* has priority over *Bronteus* Goldfuss, a term which was substituted for *Brontes* of the same author on finding that the latter appellation was preoccupied."—von Zittel's Text-book of Pal., vol. I, p. 720, 1913.

²N. Y. State Mus., Mem. 9, pt. I, p. 104, 1908.

³op. cit., p. 250.

Order Proparia

Family Phacopidae

Genus *Dalmanites* Barrande*Dalmanites* cf. *griffoni* Clarke

Plate 55, figure 1

Description.—A few portions of cephala, that present a considerable range in size, suggest that of *D. griffoni* described by Clarke from the St. Alban beds of Gaspe.

Clarke's description follows:¹ "There occurs in the Grande Cavee outcrops a *Dalmanites* having the characters of *D. micurus* Green. In lobation of tail there is little to distinguish it from that species and the general outline of the head and of the glabellar lobes is similar, but in excavating these fossils from the compact residual clay into which the rock has altered, I observed and made sketch of a cephalon on the anterior limb of which was a very pronounced elongate and spatulate extension, as is represented in the outline in our figure. This was so fragile that I was unable to preserve it and no other specimen of the cephalon was complete in this frontal region. It is such a prolongation or snout as one sees in Salter's figure of *D. longicaudatus* (British Trilobites, 1864, pl. 3, fig. 19., from the Wenlock shale which one may regard as an incipient condition of the *Probolium* condition. It seems, hence, eminently appropriate to find this development accompanying a condition of complete glabellar lobation characteristic of true *Odontochile*, and likewise to find this expression of *Dalmanites* in earliest Devonian as well as in latest Siluric rocks."

In the case of the best preserved specimen, the width of the snout at its inception is 10 mm. and its probable length about 5 mm.; the one eye preserved has an elevation of about 8 ranges of lenses; the unexfoliated portion—practically all of the border and small portions of the cephalon contiguous to the border—appears granulose under the hand lens. The axial length of the cephalon—inclusive of the snout—was about 26 mm. and the width about 52 mm.

Dalmanites sp.

Plate 55, figures 2-7; plate 56, figure 1

Description.—Several portions of pygidia and cephala are provisionally regarded as representatives of a single species—probably that of the specimens described above as suggestive of *D. griffoni* Clarke.

The specimen that represents the smallest cephalon, which had an axial length of about 10 mm. and a width of about 20 mm., retains one eye which has an elevation of 8 ranges of lenses.

The best preserved specimen, and the one that represents the smallest pygidium—length, inclusive of spine, 18 mm., width, 22 mm.—retains the impression of the spine which was about 1/12 of the total length of the pygidium, has 21 axial annulations, and 15 pleural ribs. Two of the remaining specimens have about 21 axial annulations and 14 or 15 pleural ribs, and the indications are that the others, which are more incomplete, originally had a like number.

The surface of the specimens appears granulose to the unaided eye or under the hand lens.

Dalmanites carlhwegi n. sp.

Plate 56, figure 2

Description.—Pygidium triangular, slopes rather abruptly at sides, length—inclusive of spine—about 3/4 of width; posterior extremity a short, slightly upturned,

¹N. Y. State Mus., Mem. 9, pt. 1, p. 103, pl. 7, fig. 4; pl. 9, fig. 4, 1908.

claw-like spine that is about $1/12$ of total length of pygidium; elevated axially from posterior extremity of axis into caudal spine. Axis consists of about 16 or 17 rounded annulations, tapers regularly; its length about $4/5$ that of entire pygidium, its width at anterior end about $3/11$ of width of pygidium, its width at posterior end about $1/3$ that at anterior end. Each lateral lobe has 12 or 13 rounded ribs which are wider than intervening furrows and marked with narrow, shallow, longitudinal groove. Surface appears granulose under hand lens.

Dimensions—Two of the specimens are of equal size, more nearly complete, and slightly larger than the others. The two larger specimens: Length—inclusive of spine—25.5 mm., width 32 mm., length of axis 20 mm., anterior width of axis 9 mm., length of spine 2 mm., width of border 1.5 mm.

Remarks—This pygidium is distinguished by the short, slightly upturned, claw-like caudal spine.

A number of parts of pygidia that are in all probability of this species cannot be referred to it with certainty because in every case the posterior portion is broken off. The range in size is indicated by the specimens figured.

Genus *Phacops* Emrich

Phacops hudsonicus Hall

Plate 56, figures 5-10

Phacops hudsonicus Hall, 1859, Pal. N. Y., vol. III, p. 355, pl. LXXIII, figs. 24a, 26-28 1861.

Phacops hudsonicus Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 571, pl. LXXI, figs. 4a-d.

Description—"Head semi-elliptical; length greater than half the width; posterior angles extended and abruptly rounded. Cheeks broad triangular, produced behind.¹ Glabella subpentagonal; length nearly one-third greater than the width. Frontal lobe very prominent, gibbous above; middle and anterior transverse furrows distinctly impressed in the cast; first annular furrow faintly defined; first annulation not prominent, with two pustules at the summit and a node at each extremity; occipital furrow and annulation strongly defined. Eyes small, extending backwards to the line of the first annular furrow, having an elevation of four ranges of lenses.

"[*Remarks*—This species is founded on a single head (the test being removed from the glabella), which is more produced in front than the *P. logani*; the eyes are smaller, and not extending so far backwards."—Hall, 1859, 1861.

"It is interesting to note that this species * * * is quite plentiful in Indian Territory, being more largely represented than the accompanying form, *P. logani*.

* * * The quantity of material examined makes it possible to add some details to Hall's description which may be amended as follows:

"Head semi-elliptical, varying somewhat in proportions but always transverse, the posterior angles extended and abruptly rounded. Cheeks triangular and produced behind.

"Glabella subpentagonal; transverse, usually having the width $1\frac{1}{2}$ times as great as the length; tumid, produced, and covered with pustulose tubercles. The upper and middle furrows are faint, but the basal furrow is strong and deep. The basal lobe of the glabella strongly outlined by the basal furrow above, the occipital furrow below, and by the rapidly converging axial furrows. It is short, with a detached node at each extremity.

"The occipital ring is strongly elevated, usually rising to a pointed node in the center and with two less distinct nodes at the sides.

¹The description to this point is given by Hall on the explanatory page for plate LXXIII and is the correction for this part of his description on page 355.

"The cheeks are triangular, more or less produced and rather abruptly rounded behind.

"Eyes small, extending backward to the line of the basal furrow and with an elevation of four ranges of lenses.

"The axis of the thorax is prominent and narrower than the lateral lobes, the annulations being furnished with a node at each extremity. The lateral lobes are nearly plane and horizontal toward the axis, but are abruptly bent downward a little less than half their length from the axis. Each pleura is grooved, the groove extending beyond the point of curvature.

"The surface of the pygidium and thoracic segments is finely granulose, as is that of the cheeks of the cephalic shield, but the portions of the latter adjacent to the glabella, as well as the glabella itself, are raised into granulose pustules of several sizes.

"This species is extremely close to *P. logani*, with which it is associated, and the only character which, to my knowledge, can be relied upon to distinguish them is the comparative size and number of facets in their eyes. As pointed out by Hall, the eyes of *P. hudsonicus* are smaller and possess fewer lenses than *P. logani*. The occipital ring of the latter species has usually a pointed pustule in the center. This character is never found in *P. logani*, so far as my experience goes, but, on the other hand, it is variable in *P. hudsonicus*, and I believe sometimes inconspicuous. Otherwise the two species seem to be in perfect agreement. The character of the eyes is scarcely one in which we would expect to see a sexual difference manifested, but possibly the existing difference is of that character. However, apparent facts of distribution would seem to oppose such an interpretation."—Girty, 1899.

Remarks—Several parts of cephalo are assigned to this species. The eyes of one have an elevation of 3 ranges of lenses; those of the others an elevation of 4 ranges. One exhibits a small spine at the genal angle. The surface is ornamented with granules which vary from those visible only under the hand lens to those visible to the unaided eye—most of the larger granules are confined to the glabella. The range in size of the cephalo represented follows: Axial length about 7 to about 10 mm., width 13.5 to 19 mm. The cephalon described and figured by Hall has an axial length of 13 mm. and a width of 24.5 mm.

A few portions of cephalo that resemble those mentioned above can be but doubtfully referred to *P. hudsonicus*.

The following is a description of a number of complete, or nearly complete, pygidia that are provisionally included here; pygidium semicircular, posterior and lateral slopes abrupt; axis prominent, composed of 9 or 10 rounded annulations; each lateral lobe has 7 to 9 rounded ribs that are wider than intervening furrows; each rib, except anterior one of each lobe, marked with narrow, shallow, longitudinal groove; surface ornamented with granules of unequal size—larger ones visible to naked eye. The range in size of the pygidia is: Length about 4.5 to 7 mm., width about 7 to 12 mm.

Phacops logani Hall

Plate 56, figures 16, 17

Phacops logani Hall, 1859, Pal. N. Y., vol. III, p. 353, pl. LXXIII, figs. 15-24 (not 24a) 25, 1861.

Phacops logani Girty, 1899, U. S. Geol. Surv., 19th Ann. Rept., pt. III, p. 571.

Phacops logani Clarke, 1900, N. Y. State Mus., Mem. 3, p. 21, pl. I, figs. 1-5.

Phacops logani Weller, 1903, Pal. N. J., vol. III, p. 321, pl. XL, figs. 3, 4.

Phacops logani Shimer, 1905, N. Y. State Mus., Bull. 80, p. 260.

Phacops logani Clarke, 1908, N. Y. State Mus., Mem. 9, pt. 1, pp. 103, 118, pl. 10, figs. 1-4, 7-9.

Phacops logani Clarke, 1909, N. Y. State Mus., Mem. 9, pt. 2, p. 138.

Phacops logani Ohern, 1913, Md. Geol. Surv., L. Dev., p. 497, pl. XCI, figs. 1-4.

Phacops logani Dunbar, 1919, Tenn. Geol. Surv., Bull. 21, pl. 2, fig. 18.

Description—"General form elliptical. Head semi-circular in outline, broadly concave above, with the posterior angles curved and declining more abruptly. Glabella somewhat pentagonal; length and greatest breadth nearly in the proportion of three to four; very prominent in front, projecting beyond the rudimentary frontal limb, which becomes more developed on each side, and below which is a defined groove, marking the limits of the lower side of the cephalic test. Upper surface convex, gibbous in front, having two pairs of transverse grooves, the middle and posterior ones of which are but faintly defined; while the third or anterior ones, extending from the inner angle of the eye backwards and a little inwards, are scarcely conspicuous, and, on many specimens, not observable. First annular furrow strongly defined, and sometimes with a small tubercle at the summit; first or intercalated annulation narrow and well defined, and terminated at each extremity by a strong oblong tubercle, which is wider than the annulation, and usually marked by two pustules at the summit, one on each side of the centre. Occipital furrow wider and more strongly defined than the intercalated one, slightly sinuous, and terminating in a deep cavity at each extremity; occipital annulation broad and strong, slightly sinuate at the extremities, and, when entire, marked by one larger central pustule and several smaller ones. Eyes of medium size, their summit less elevated than the glabella, extending backwards to the line of the occipital furrow, composed of seventeen vertical ranges of lenses; the entire number of lenses in full-grown specimens about one hundred, and varying in the specimens examined from ninety-three to one hundred and three. The axis of the thorax is prominent, and narrower than each of the lateral lobes; the annulations furnished with a prominent node at each extremity. The lateral lobes are flat or somewhat concave towards the axis, the articulations bending abruptly downward from the middle towards the extremities; each articulation strongly grooved, the groove extending beyond the curvature. Pygidium semi-circular; the axis prominent, with about nine annulations; the lateral lobes having about five or six ribs, each with a groove along the centre. Surface of the glabella pustulose, and of the articulations granulose, with some larger granules or pustules. The crust is thin, and the interior of the glabella shows distinct cavities corresponding to the external pustules. Hypostoma broad hastate; the buccal extremity obtuse, with a minute central point."—Hall, 1859.

Remarks—The incomplete cephalon observed departs from the foregoing description in that the eyes extend backward only to the line of the first annular furrow. As shown by the portions preserved, the eyes originally had at least 15 vertical ranges of lenses and an elevation of at least 6 ranges. The surface of the incomplete cephalon is marked with subequal granules—visible to the naked eye.

Dimensions—Axial length about 11 mm., width 23 mm.

PLATE NO. 40

PLATE 40

Hindia fibrosa (Roemer)

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Fig. 1. An incomplete sponge.

Figs. 2, 3. Complete individuals.

Fig. 4. A specimen that shows the radial canals and spicules. (X2).

Streptelasma strictum Hall

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Figs. 5-8. Side views of incomplete coralla.

Fig. 9. Top view.

Fig. 10. Side view.

Fig. 11. Top view.

Favosites heiderbergiae Hall

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Fig. 12. Top view of a portion of a corallum.

Figs. 13-16. Side views of specimens.

Fig. 17. Top view of a fragment of a corallum.



PLATE NO. 41

PLATE 41

Favosites helderbergiæ Hall

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Fig. 1. Side view of a portion of a corallum.

Favosites conicus Hall

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Fig. 2. Basal view of an incomplete individual.

Figs. 3, 4. Side and basal views of a portion of a corallum.

Fig. 5. Side view of an incomplete corallum.

Fig. 6. Basal view of a specimen.

Fig. 7. Side view of a specimen.

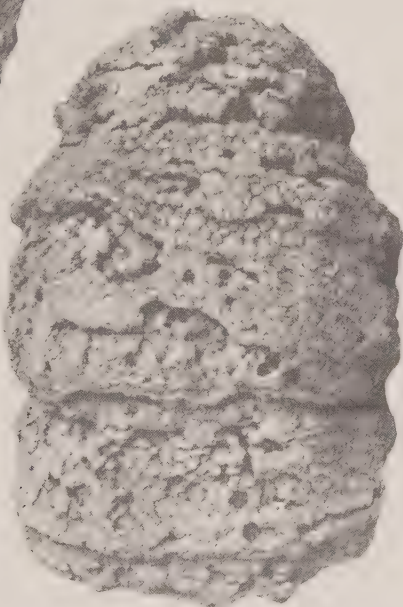
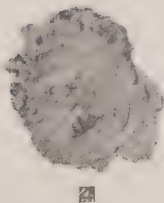
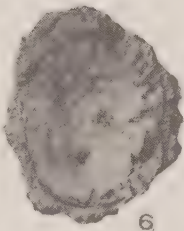
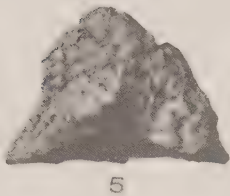
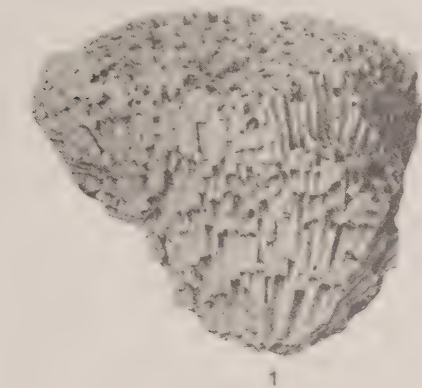


PLATE NO. 42

PLATE 42

Striatopora missouriensis Meek and Worthen?

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Figs. 1-3. Portions of coralla.

Fig. 4. Portion (fig. 1). (X2).

Striatopora bella Swartz

Page 179.

Figs. 5, 6. Parts of coralla. (X2).

Figs. 7, 8. Portions of coralla.

Pleurodictyum lenticulare (Hall)?

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Fig. 9. Top view of a portion of the corallum. (X2).

Scyphocrinus sp.

Page 180.

Fig. 10. Top view of an incomplete root-bulb.



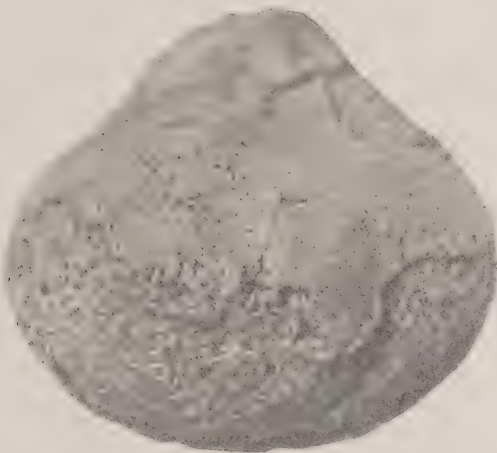
PLATE NO. 43

PLATE 43

Scyphocrinus sp.

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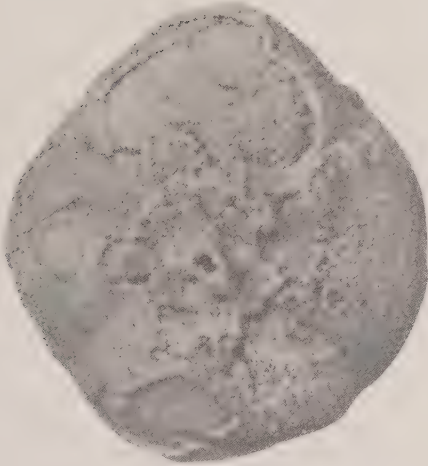
- Fig. 1. Side view of an incomplete root-bulb that retains part of the collar.
Fig. 2. Top view of an incomplete root-bulb.
Figs. 3, 4. A portion of the unweathered surface of a root-bulb to show the polygonal character of the plates, and a portion of the weathered surface of the same bulb to show the stellate character.
Fig. 5. Side view of an incomplete calyx.
Fig. 6. Basal view of a portion of a calyx.



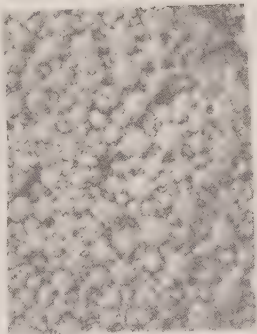
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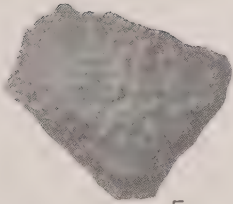
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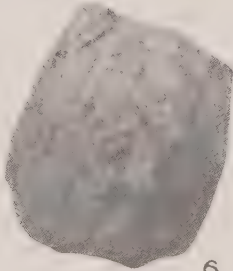
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PLATE NO. 44

PLATE 44

Edriocrinus ? sp.

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Figs. 1-3. Side, top and basal views of the portion of a calyx.

Alsopocrinus anna n. sp.

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Figs. 4-6. Side views and basal view of the incomplete dorsal cup.

Fistulipora ? sp.

Page 181.

Fig. 7. Portion of a zoarium. (X2).

Fenestella ? sp.

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Fig. 8. The fragment shows the non-celluliferous face of a zoarium. (X2).

Crania alsopi n. sp.

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Meristella princeps Hall

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Figs. 9-11. Dorsal and side views of the uncrushed specimen, and dorsal view of the crushed specimen attached to the representative of *Meristella princeps*

Dalmanella planoconvexa (Hall)

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Figs. 12, 13. Ventral and posterior views.

Figs. 14-16. Ventral, dorsal, and posterior views.

Fig. 17. An incomplete dorsal valve.

Dalmanella perelegans (Hall)

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Fig. 18. Dorsal view.

Fig. 19. Interior of a fragment of a dorsal valve.

Figs. 20-24. Ventral, dorsal, posterior, anterior and side views.

Figs. 25, 26. Ventral and dorsal views.

Dalmanella quadrans (Hall)

Page 183.

Fig. 27. An incomplete dorsal valve.

Fig. 29. An incomplete dorsal valve.

Fig. 28. An incomplete ventral valve.

Figs. 30, 31. Dorsal and ventral views.

Rhipidomella oblata (Hall)

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Figs. 32, 33. Side and posterior views.



PLATE NO. 45

PLATE 45

Rhipidomella oblata (Hall)

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- Figs. 1, 2. Dorsal and ventral views.
Figs. 3, 4. Dorsal and ventral views.
Fig. 5. An incomplete ventral valve.
Fig. 6. A ventral valve.
Figs. 7, 8. Incomplete dorsal valves.

Rhipidomella discus (Hall)

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- Figs. 9-12. Dorsal, ventral, side and posterior views.
Fig. 13. Dorsal view.
Fig. 14. An incomplete dorsal valve.
Figs. 15, 16. Ventral and dorsal views.

Rhipidomella ellsworthi n. sp.

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- Figs. 17-31. Ventral, dorsal, side, anterior and posterior views of three shells.
Figs. 32, 33. Ventral and anterior views.
Fig. 34. Dorsal view.
Fig. 35. Ventral view.
Fig. 36. Ventral view.
Fig. 37. Ventral view.
Fig. 38. An incomplete ventral valve.
Fig. 39. An incomplete dorsal valve.



PLATE NO. 46

PLATE 46

Rhipidomella melvillei n. sp.

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- Figs. 1-10. Ventral, dorsal, posterior, anterior, and side views of two specimens.
Figs. 11-13. Ventral, dorsal, and anterior views.
Figs. 14, 15. Ventral and dorsal views.
Fig. 16. Ventral view.
Fig. 17. An incomplete ventral valve.

Bilobites varica (Conrad)

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- Figs. 18-20. Ventral, dorsal, and anterior views.
Figs. 21-23. Ventral, dorsal, and posterior views.
Fig. 24. Ventral view.
Fig. 25. Dorsal view.

Leptaena rhomboidalis (Wilckens)

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- Fig. 26. A partially exfoliated, incomplete ventral valve.
Fig. 27. Interior of an incomplete dorsal valve.
Fig. 28. A partially exfoliated, incomplete ventral valve.
Fig. 29. Internal cast of an incomplete ventral valve.
Fig. 30. External cast of a part of a dorsal valve.
Fig. 31. Dorsal view.
Fig. 32. Ventral view.

Stropheodonta arata (Hall)

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- Fig. 33. Almost complete external cast of an incomplete dorsal valve.
Figs. 34, 35. Ventral and side views of a partially exfoliated, incomplete ventral valve.

Stropheodonta (Leptostrophia) planulata (Hall)

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- Fig. 36. An incomplete ventral valve.
Fig. 37. Interior of a portion of a ventral valve.
Fig. 38. A partially exfoliated, incomplete ventral valve.

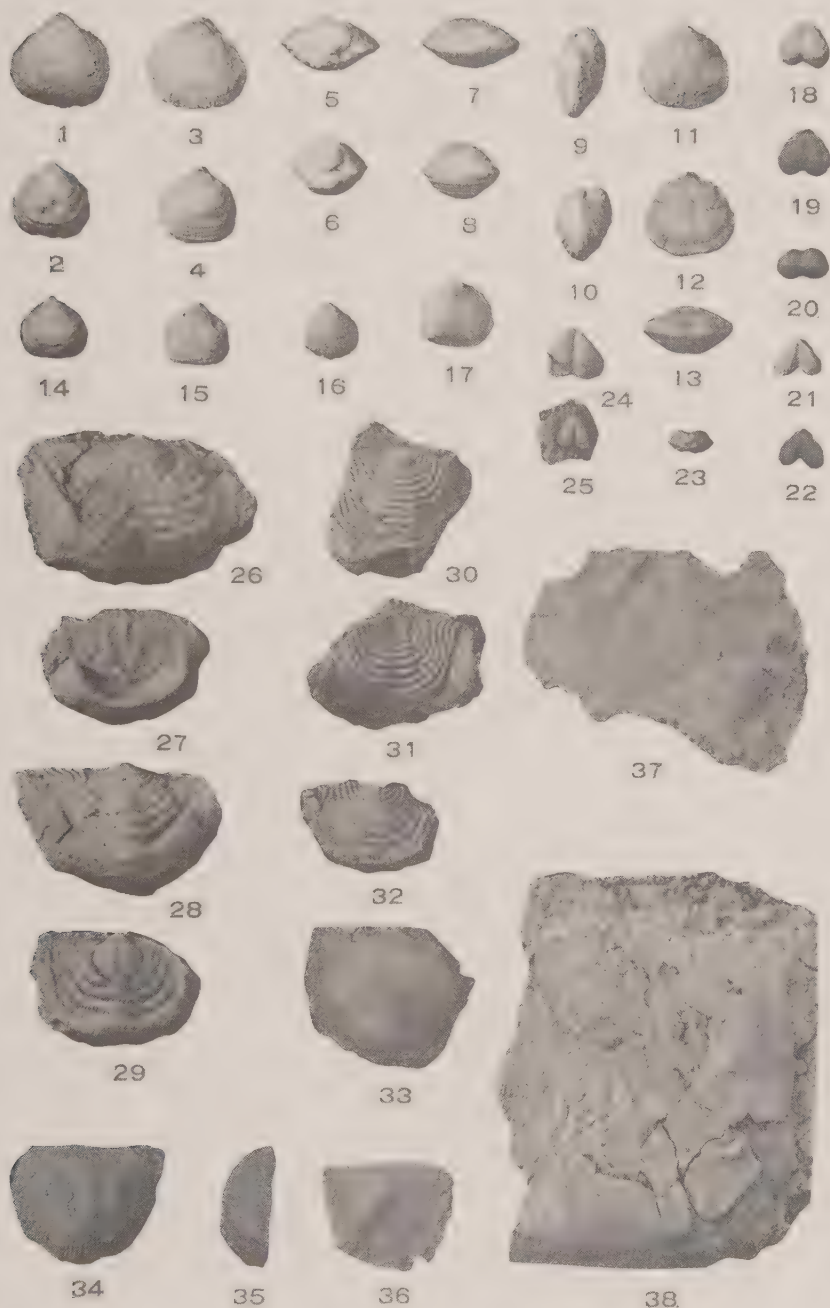


PLATE NO. 47

PLATE 47

Stropheodonta (Leptostrophia) planulata (Hall)

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Figs. 1, 2. Partially exfoliated, incomplete ventral valves.

Strophonella punctulifera (Conrad)

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Figs. 3, 4. A partial cast of the interior of an incomplete ventral valve, and the corresponding partial interior of the valve

Fig. 5. Interior of a portion of a ventral valve.

Fig. 6. Interior of an incomplete ventral valve.

Leptaenisca concava (Hall)

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Figs. 7-12. Ventral and posterior views of three incomplete shells.

Figs. 13, 14. Incomplete ventral valves.

Fig. 15. Dorsal view.

Fig. 16. Interior of a portion of a ventral valve.

Anastrophia verneuili (Hall)

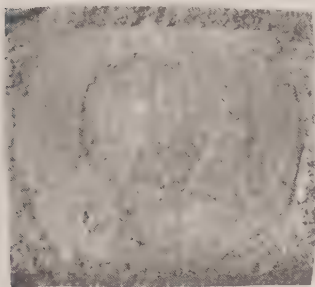
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Figs. 17, 18. Interior of parts of dorsal valves.

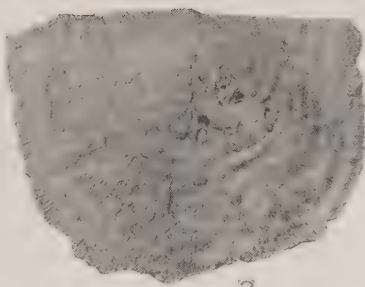
Fig. 19. Interior of a portion of a ventral valve.

Fig. 20. Dorsal view of an incomplete shell with unusually fine plications.

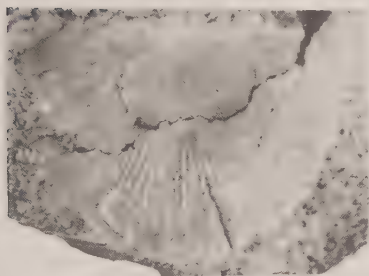
Fig. 21. Dorsal view of a specimen with relatively coarse plications.



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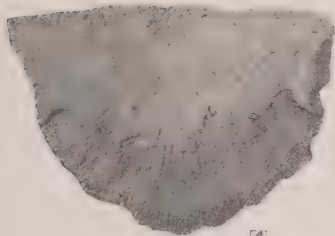
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9



12



4



13



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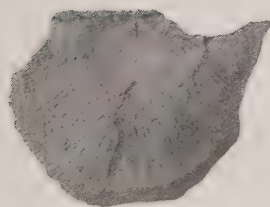
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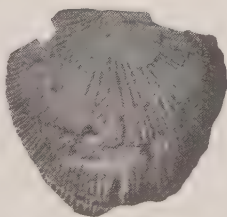
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PLATE NO. 48

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Anastrophia verneuilii (Hall)

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Figs. 1-3. Ventral, dorsal, and anterior views.

Figs. 4-6. Ventral, dorsal, and side views.

Figs. 7-9. Ventral, dorsal, and anterior views.

Gypidula multicosata Dunbar

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Fig. 10. A portion of a ventral valve with 12 plications on the fold.

Figs. 11, 12. Anterior and ventral views.

Fig. 13. Interior of an incomplete ventral valve.

Fig. 14. Interior of an incomplete ventral valve.

Figs. 15-17. Ventral, dorsal, and side views.

Fig. 18. An incomplete ventral valve.

Fig. 19. Anterior view.

Rhynchotrema formosa (Hall)

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Figs. 20-22. Side, ventral, and dorsal views of the one specimen.



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Eatonia singularis (Vanuxem)

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Figs. 1, 2. Ventral and anterior views of the single specimen.

Uncinulus nucleolatus (Hall)

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Figs. 3, 4. Anterior and dorsal views.

Fig. 5. Dorsal view of a specimen with 5 plications on the fold.

Figs. 6-11. Side and anterior views of three specimens.

Figs. 12-14. Anterior, dorsal, and side views.

Fig. 15. Posterior view.

Fig. 16. Posterior view of a portion of a shell.

Uncinulus mutabilis (Hall)

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Figs. 17-19. Dorsal, side, and anterior views.

Fig. 20. An incomplete ventral valve.

Fig. 21. Side view.

Fig. 22. Dorsal view.

Uncinulus subpyramidatus n. sp.

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Figs. 23-30. Dorsal, anterior, side, and ventral views of two incomplete shells.

Figs. 31, 32. Dorsal and anterior views.

Fig. 33. Anterior view.

Fig. 34. Dorsal view.

Wilsonia wadei Dunbar

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Figs. 35-46. Ventral, dorsal, side, and anterior views of three specimens.

Figs. 47-48. Interior of incomplete ventral valves.

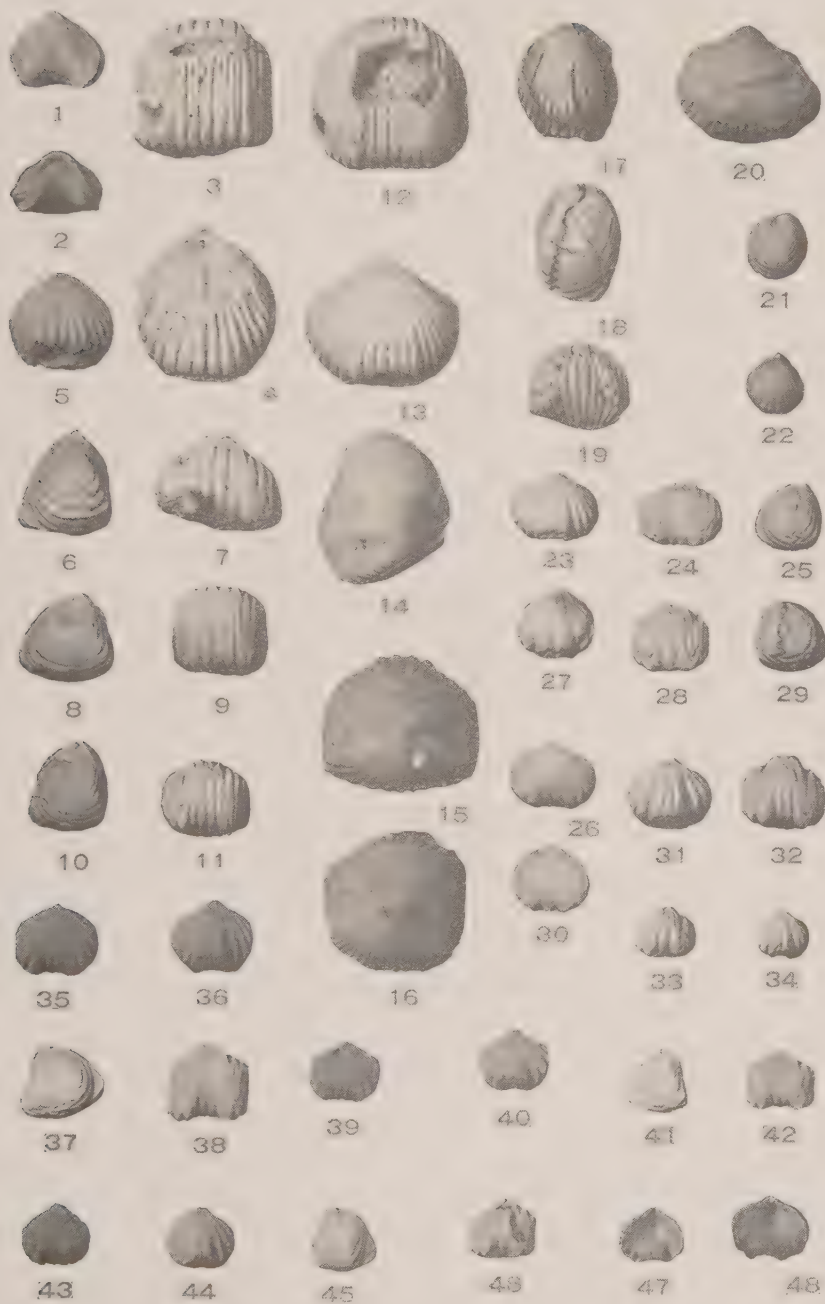


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Wilsonia wadei Dunbar

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Figs. 1, 2. Ventral and side views.

Figs. 3, 4. Dorsal and anterior views.

Rhynchonella transversa Hall

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Figs. 5-12. Dorsal, side, ventral, and anterior views of two specimens.

Figs. 13-15. Dorsal, side, and ventral views.

Fig. 16. Dorsal view.

Fig. 17. Side view.

Fig. 18. Posterior view.

Fig. 19. Ventral view.

Fig. 20. Side view.

Rhynchonella (?) *bialveata* Hall

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Figs. 21-23. Ventral, dorsal, and side views of one specimen.

Fig. 24. Dorsal view of the other observed specimen.

Rensselaerina medioplicata Dunbar

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Figs. 25, 26. Dorsal and anterior views of the one specimen.

Atrypina imbricata (Hall)

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Figs. 27-29. Side, ventral, and dorsal views of the single specimen.

Atrypa reticularis (Linne)

Page 198.

Fig. 30. An incomplete, elongate ventral valve.

Fig. 31. Internal cast of a ventral valve.

Fig. 32. Posterior view.

Figs. 33, 34. Ventral and anterior views.

Fig. 35. Side view of an incomplete shell with numerous growth lines.

Fig. 36. Anterior view of a specimen that shows the remains of fringes.

Fig. 37. A dorsal valve that shows the remains of fringes.

Fig. 38. An incomplete ventral valve that retains the remnants of fringes.

Fig. 39. Anterior view of a specimen with a prominent dorsal fold.

Fig. 40. Anterior view of a variety.

Delthyris perlamellosus (Hall)

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Fig. 41. Ventral view.

Figs. 42, 43. Dorsal and side views.

Figs. 44-49. Dorsal, side, and anterior views of two specimens.



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Delthyris missouriensis n. sp.

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- Figs. 1-6. Posterior, side, and ventral views of two specimens.
Figs. 7, 8. Posterior and side views.
Fig. 9. A portion of a ventral valve.
Fig. 10. Interior of a fragment of a ventral valve.
Fig. 11. Dorsal view.

Spirifer cyclopterus Hall

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- Figs. 12, 13. Ventral and dorsal views.
Figs. 14-16. Dorsal, ventral, and posterior views.
Figs. 17-19. Dorsal, ventral, and anterior views.
Figs. 20, 21. Incomplete dorsal valves.
Figs. 22, 23. Interior of fragments of ventral valves.
Fig. 24. Side view.
Fig. 25. Ventral view.
Fig. 26. Dorsal view of an incomplete shell on which the medial depression of the fold is well-marked, and which has a bifurcated plication.
Fig. 27. A portion of a ventral valve.

Delthyris octocostatus (Hall) ?

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- Figs. 28, 29. Ventral and dorsal views of the single specimen.

Cyrtina dalmani (Hall)

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- Fig. 30. Posterior view.
Fig. 31. Dorsal view.



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Cyrtina dalmani (Hall)

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Figs. 1, 3. Ventral, dorsal, and posterior views.

Fig. 4. Central view of a portion of a shell.

Rhynchospira formosa Hall

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Figs. 5-7. Ventral, dorsal, and side views.

Figs. 8-11. Ventral and dorsal views of two specimens.

Figs. 12-14. Ventral, dorsal, and side views.

Fig. 15. Side view.

Fig. 16. Anterior view of a perfect individual.

Fig. 17. Ventral view of a variety.

Fig. 18. Dorsal view.

Trematospira equistriata Hall and Clarke

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Figs. 19, 20. Ventral and posterior views of the one specimen.

Nucleospira ventricosa Hall

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Fig. 21. Ventral view.

Fig. 22. Ventral view.

Figs. 23, 24. Ventral and anterior views.

Figs. 25, 26. Dorsal and anterior views.

Figs. 27-30. Anterior, dorsal, ventral, and side views.

Figs. 31-33. Dorsal, ventral, and posterior views.

Meristella laevis (Vanuxem)

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Figs. 34-36. Ventral, dorsal, and side views.

Figs. 37-44. Ventral, dorsal, side, and anterior views of two specimens.



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PLATE 53

Meristella laevis (Vanuxem)

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Figs. 1, 2. Dorsal and side views.

Meristella bella Hall

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Figs. 3-6. Ventral, dorsal, side, and anterior views of the single specimen.

Meristella atoka Girty

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Figs. 7-10. Dorsal and side views of two specimens.

Figs. 11, 12. Dorsal and anterior views.

Figs. 13-15. Side, dorsal, and anterior views of a partially restored shell.

Fig. 16. Dorsal view of an almost completely exfoliated individual.

Fig. 17. An incomplete ventral valve.

Fig. 18. Internal cast of a ventral valve.

Fig. 19. A partially exfoliated ventral valve.

Fig. 20. Anterior view of an almost wholly exfoliated individual.

Rensselaerina medioplicata var. *laticornis* Dunbar (?)

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Figs. 21, 22. Dorsal and side views of a portion of a shell.

Fig. 23. A portion of a ventral valve.

Fig. 24. Side view; the marked projection of the ventral above the dorsal beak is due to distortion.



PLATE NO. 54

PLATE 54.

Rensselaerina medioplicata var. *latior* Dunbar (?)
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- Fig. 1. Ventral view of a portion of a shell.
Fig. 2. A portion of a ventral valve.
Fig. 3. Interior of a fragment of a dorsal valve.
Fig. 4. Interior of a part of a ventral valve.

Pteronitella (?) sp.
Page 205.

- Fig. 5. Internal cast of a portion of a left valve—the only specimen observed.

Conocardium sp.
Page 205.

- Fig. 6. The one specimen—an internal cast of a part of a left valve.

Aviculopecten (?) *umbonata* (Hall) (?)
Page 205.

- Fig. 7. An incomplete left valve that retains portions of the shell.
Fig. 8. A portion of a left valve.

Cypricardinia distincta Billings (?)
Page 206.

- Fig. 9. The single specimen—an incomplete left valve.

Platyceras pentalobus Hall.
Page 207.

- Fig. 10. Ventral view.
Fig. 11. Upper view.
Fig. 12. Upper view.
Figs. 13-15. Upper, lower, and ventral views.
Figs. 16, 17. Upper and lower views.
Figs. 18-20. Upper, lower, and ventral views.

Platyceras sp.
Page 207.

- Figs. 21, 22. Upper and dorsal views of the partially exfoliated individual.

Platyceras (?) sp.
Page 207.

- Figs. 23, 24. Dorsal and ventral views of the specimen.

Diaphorostoma sp.
Page 207.

- Figs. 25, 26. Upper and ventral views of the single representative—an internal cast.

Goldius barrandii Hall
Page 208.

- Fig. 27. The sole specimen—a portion of a pygidium.



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Dalmanites cf. griffoni Clarke

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Fig. 1. An almost wholly exfoliated, incomplete cephalon.

Dalmanites sp.

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Fig. 2. A partially exfoliated portion of a glabella.

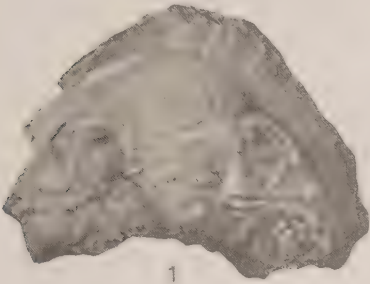
Fig. 3. Interior of a part of a cephalon.

Fig. 4. A fragment of a cephalon with the impression of the genal spine.

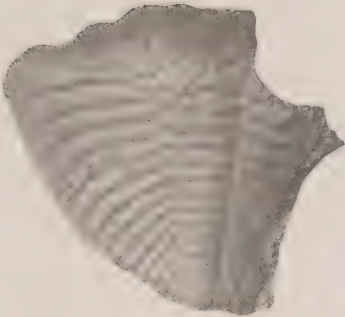
Fig. 5. A part of a pygidium.

Fig. 6. A nearly complete pygidium.

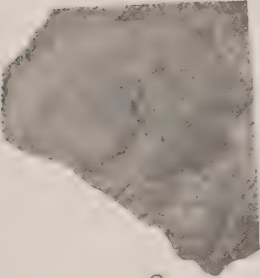
Fig. 7. A part of a pygidium that retains portions of the test.



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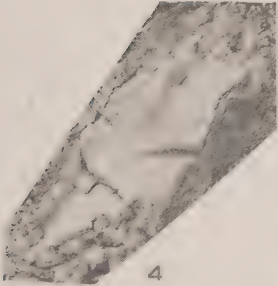
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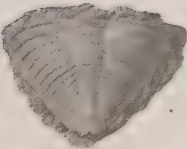
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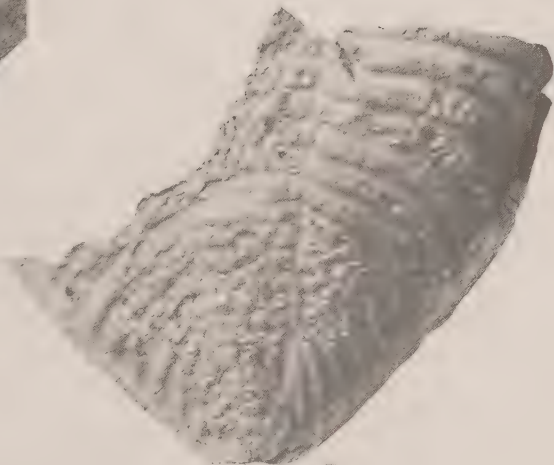
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Dalmanites sp.

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Fig. 1. A portion of a pygidium—partially exfoliated.

Dalmanites carlwegi n. sp.

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Fig. 2. An incomplete pygidium.

Dalmanites carlwegi n. sp. (?)

Page 209.

Fig. 3. A part of a pygidium.

Fig. 4. An incomplete pygidium.

Phacops hudsonicus Hall

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Figs. 5, 6. Top and side views of a partially exfoliated portion of a cephalon.

Fig. 7. A part of a cephalon—the eye has an elevation of 3 ranges of lenses.

Figs. 8, 9. Top and side views of a portion of a cephalon.

Fig. 10. An almost wholly exfoliated, incomplete cephalon.

Phacops hudsonicus Hall (?)

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Fig. 11. An incomplete pygidium.

Figs. 12, 13. Pygidia.

Figs. 14, 15. Parts of cephalia.

Phacops logani Hall

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Figs. 16, 17. Top and side views of the single, partially exfoliated, incomplete cephalon.

